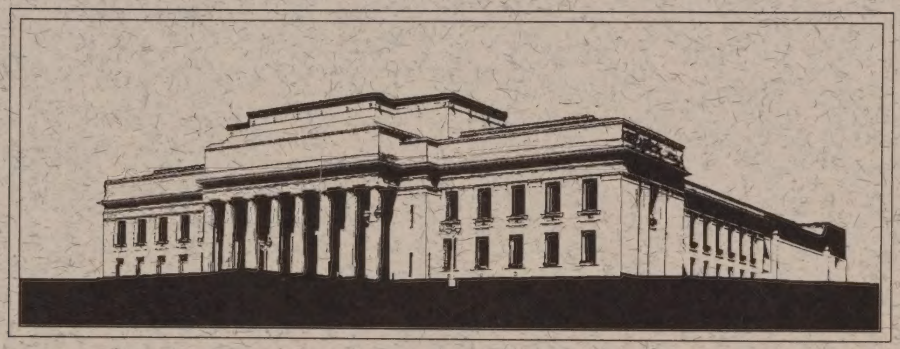

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CONTENTS

PALAEONTOLOGY Page

A new fossil isocrinid crinoid from the late Oligocene of Waitete Bay, northern Coromandel
MICHAEL K. EAGLE 1

Oligocene paleontology and paleoecology of Waitete Bay, northern Coromandel Peninsula
MICHAEL K. EAGLE and BRUCE W. HAYWARD 13

ZOOLOGY

Descriptions and redescriptions of landsnails (Mollusca: Punctidae) in the genera *Phrixgnathus* and *Taguahelix*
F.M. CLIMO and J.F. GOULSTONE 27

Menimus crosbyi, a new name for *M. clarkei* Watt, 1992 (Coleoptera: Tenebrionidae) [SHORT NOTE]
J.C. WATT 47

Primary types of terrestrial and freshwater Protista, Annelida and Arthropoda in the Auckland Institute and Museum: an annotated list
J.W. EARLY and R.F. GILBERT 49

Natal down and egg size of the kokako *Callaeas cinerea* (Aves: Callaeidae)
B.J. GILL 87

Species of *Micromus* (Neuroptera: Hemerobiidae) in New Zealand
K.A.J. WISE 93

A NEW FOSSIL ISOCRINID CRINOID FROM THE LATE OLIGOCENE OF WAITETE BAY, NORTHERN COROMANDEL

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Abstract. A new species of the crinoid *Nielsenicrinus* is described from the late Oligocene Torehina Formation, Coromandel, North Island, New Zealand. It lived in an inner-shelf, marine paleoenvironment no deeper than 50 m.

During fieldwork in Waitete Bay, Coromandel, on 22 December 1992, crinoidal remains were collected from a sandy, flaggy limestone of the Torehina Formation (Kear 1955) of Duntroonian age, near the Duntroonian-Waitakian boundary (Late Oligocene, about 25 million years). Although many fossil isocrinid columnals have been recovered in New Zealand (with some being described from the Triassic; Bather 1917), this is the second formal description of a New Zealand Tertiary isocrinid. Site locality number (S10/f6, Fig.1) is that of the Geological Society of New Zealand's archival Fossil Record File; grid reference is S10/ 289010 (NZMS 260 1: 50 000 map). Crinoid stem terminology follows Moore, Jeffords & Millar (1968), Roux (1977), Ubaghs (1978) and Webster (1974).

Hutton (1873) formally described the isocrinid *Pentacrinus stellatus* from the Oamaru Formation of Southland. It has since been recorded from several other New Zealand localities, among them the Chatham Islands, Curiosity Shop in Southland, and Point Elizabeth in Westland (Figs. 5, 7). It has also been reported from strata at Wilton Bluff and Aldinga Cliffs, South Australia. McKay (1897), Park (1897), and MacLaren (1900), all reported *Pentacrinus stellatus* columnals from the Torehina marine beds of Waitete Bay (Fraser & Adams 1907). Close examination of these columnals and pluricolumnals shows them not to be *Pentacrinus* but diagnostic of the genus *Nielsenicrinus*. *Pentacrinus* is now known to have become extinct in the Late Jurassic (Simms 1988). Tertiary *"Pentacrinus"* columnals have subsequently been distributed among other genera. *"P." stellatus* has yet to be studied from this point of view.

There are many differences between the Waitete Bay species and *"P." stellatus*; overall height of *"P." stellatus* is 0.5-1.6 mm, compared with 0.5-2.7 mm for the Waitete Bay species. The columnal face of *"P." stellatus* is a level plane whereas that of the Waitete Bay species is slightly raised at the centre of the higher columnals. Radial depressions are reduced in *"P." stellatus* but distinct in the Waitete Bay species; longitudinal furrows do not transect the articular face of the former but do in the latter species. The columnal articular face of *"P." stellatus* possesses short, oval, inter-radial petals, each surrounded by 20-22 culmina; the Waitete Bay specimens have long, elliptical, inter-radial petals each surrounded by 26-28 culmina. Crenellae do not reach their greatest length at the transition from marginal to adradial position in *"P." stellatus*, whereas they do in the Waitete Bay species. The lumen is circular in *"P." stellatus*, but sub-pentagonal in the Waitete Bay species. The morphological disparity

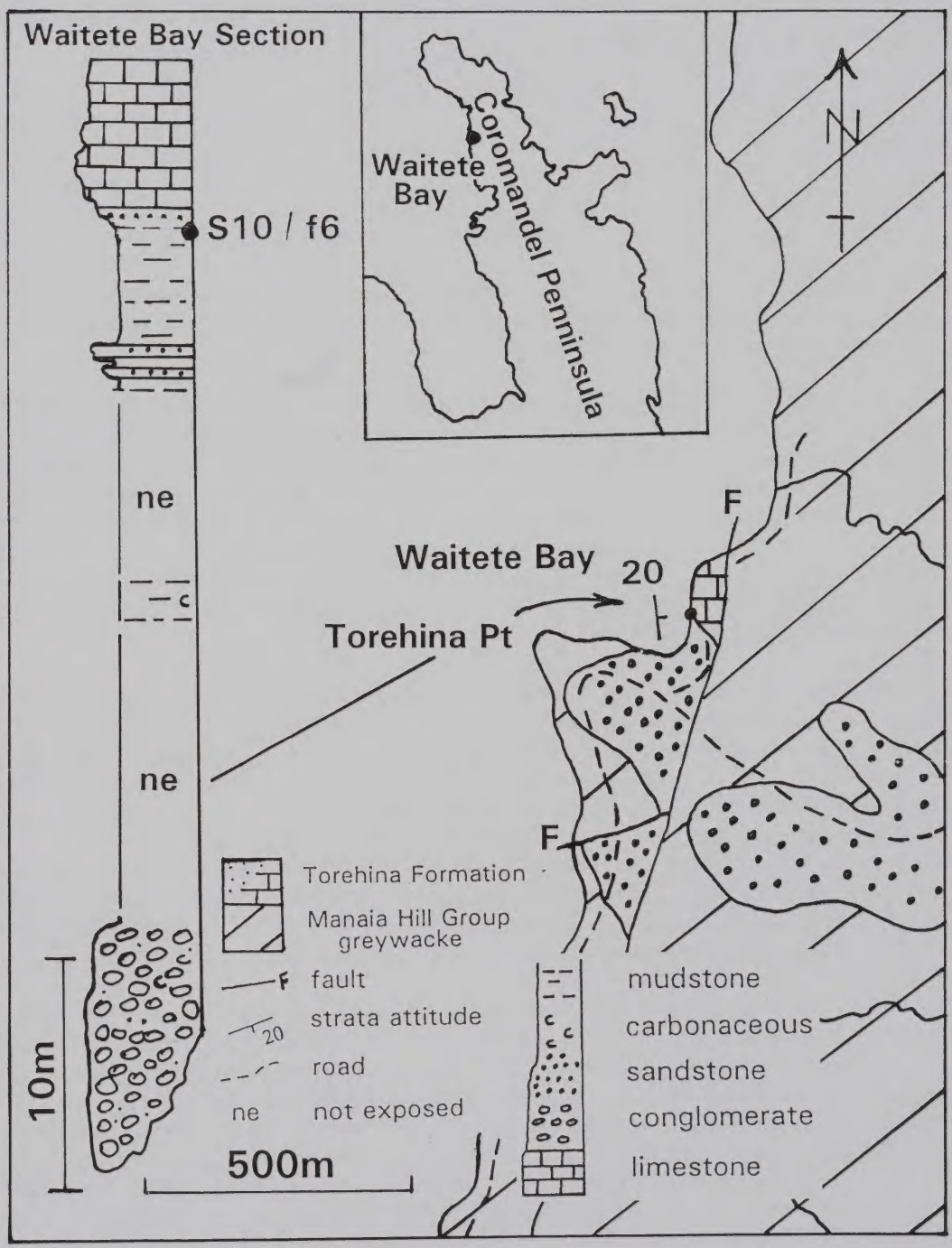


Fig. 1. Geological map of Waitete Bay area of Northern Coromandel Peninsula, with stratigraphic column for the Oligocene Torehina Formation fossil locality.

between *"P." stellatus* and the Waitete Bay specimens indicate that the latter are not *Nielsenicrinus stellatus* (Hutton), but are a new species.

Generic names have been assigned to many isocrinids on the basis of stem physiology (Rasmussen 1961). Crinoid researchers, amongst them Moore (1939) and Donovan (1984, 1988), although expressing reservations concerning this method of identification, recognise the lack of diagnostic calices in preserved material and acknowledge columnal diversity. Many taxonomic allocatons have been made on the basis of morphological criteria derived from crinoid columnals (Moore, Jeffords & Millar 1968; Roux 1977; Donovan 1984, 1988; Stukalina 1988). These have been based mainly on patterns of columnal articulation, size of basals, and arrangement of cirrus sockets, whereas Recent genera and a few established (well preserved) fossil genera are based mainly on brachial ramification and articulations (Rasmussen 1978; Donovan 1987).

SYSTEMATICS

Class	CRINOIDEA Millar, 1821
Subclass	ARTICULATA Zittel, 1879
Order	ISOCRINIDA Sieverts-Doreck, 1952
Family	ISOCRINIDAE Gislen, 1924

Articulate crinoids in which the articular face of the columnals has lanceolote to subguttiform petals surrounded by adradial and marginal crenellae. The crenellae attain their greatest length about the gradual transition from marginal to adradial position. The length of internodes is 6-17 internodals, with fewer located in the proximal region of the column. The nodals are larger than internodals with five large elliptical cirrus sockets facing outwards.

Genus	*Nielsenicrinus* Rasmussen, 1961
Type species:	*Pentacrinus obsoletus* Nielsen, 1913; original description. Paleocene (Upper Danian), Denmark.

The genus *Nielsenicrinus* was originally established to include a group of Cretaceous Isocrinidae in which a syzygial articulation I Br 1-2 is combined with a synarthrial articulation II Br 1-2. It has been found in the Upper Cretaceous and Lower and Middle Paleocene of Europe (Austria, Belgium, Denmark, England and France).

Rasmussen (1961) distinguished *Nielsenicrinus* spp. from *Isocrinus* spp. using differences in brachial articulation and calyx characteristics. Although the Waitete material consists solely of columnals, a confident generic allocation is made based on the following: A. articular face - more pentalobate than stellate in outline; a pentamerous lumen surrounded by a smooth perilumen; a lack of radial and ligmental pores common in *Isocrinus;* long, narrow lanceolate areolae instead of short, broad areolae common in *Isocrinus* (Moore & Vokes 1953; Rasmussen 1961, 1978; Klikushin 1979, 1982); the crenullae attain their greatest length about the gradual transition from marginal to adradial position (Rasmussen 1961). B. pluricolumnal - cryptosymplectical instead of syntosial articulation between the nodal and infranodal; elliptical cirri sockets exhibit circular cirral axial canal and fulcral ridge with tubercle terminations (Rasmussen 1961).

Nielsenicrinus waiteteensis n.sp. (Figs. 2-4, 6, 12, 16)

MATERIAL

Holotype. AK71631 (Auckland Institute and Museum), internodal columnal.

Paratypes. AK71632, pluricolumnal; AK71633, internodal columnal; AK71634, pluricolumnal and internodal columnal; AK71635 and AK71636, internodal columnals; AK71637, 17 specimens (a-q) columnal and pluricolumnal. E518, E519 (University of Auckland, Geology Department), separate internodal columnals.

Measurements and meristics of the columnals of eight specimens of *Nielsenicrinus waiteteensis* n.sp. are listed in Table 1.

TYPE LOCALITY AND AGE

Fossil Record File number S10/f6; grid reference S10/289010 (NZMS 260 1:50 000 map), Torehina Formation, Waitete Bay, Coromandel, New Zealand. Duntroonian (Ld) (Chattian), late Oligocene (Eagle & Hayward 1993).

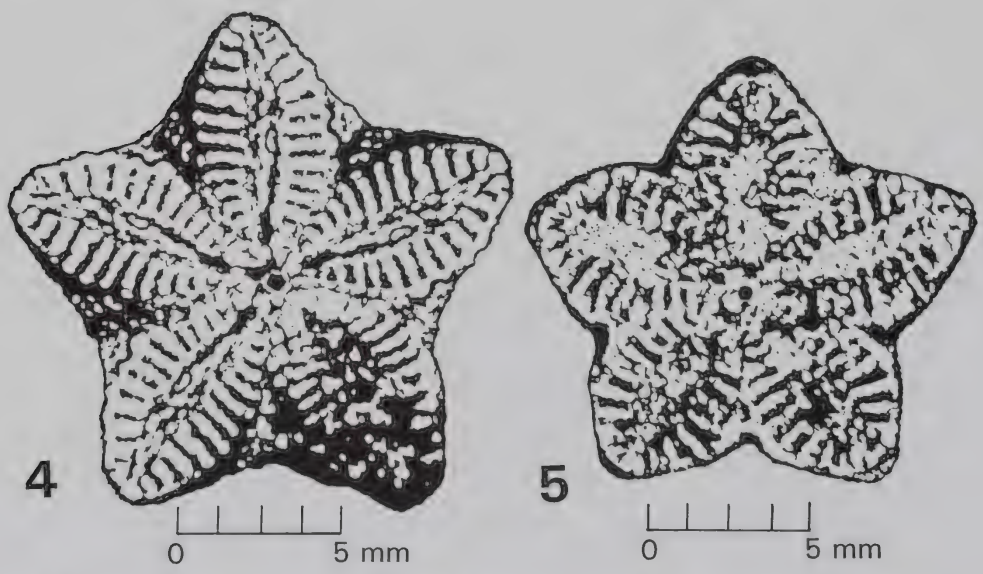
DESCRIPTION

The column is smooth, pentalobate to stellate in transverse section. Height of the columnals is 0.5-2.7 mm. Columnal diameter is almost constant; higher columnals are slightly raised at the centre of the columnal. Radial depressions at the suture are distinct in some specimens. Pluricolumnals exhibit succeeding columnals with pronounced alternating height; columnals may be more lobate so that the longitudinal radial furrows transect the articular face. Lateral sutures are finely crenulate. Columnal articular face possesses narrow, regular, elliptical, inter-radial petals, each surrounded by 26-28 culmina; half reach the periphery with the rest adradial. Lateral peripheral and radial crenulation is evenly joined. Crenellae reach their greatest length at the transition from marginal to adradial position. A small, smooth,

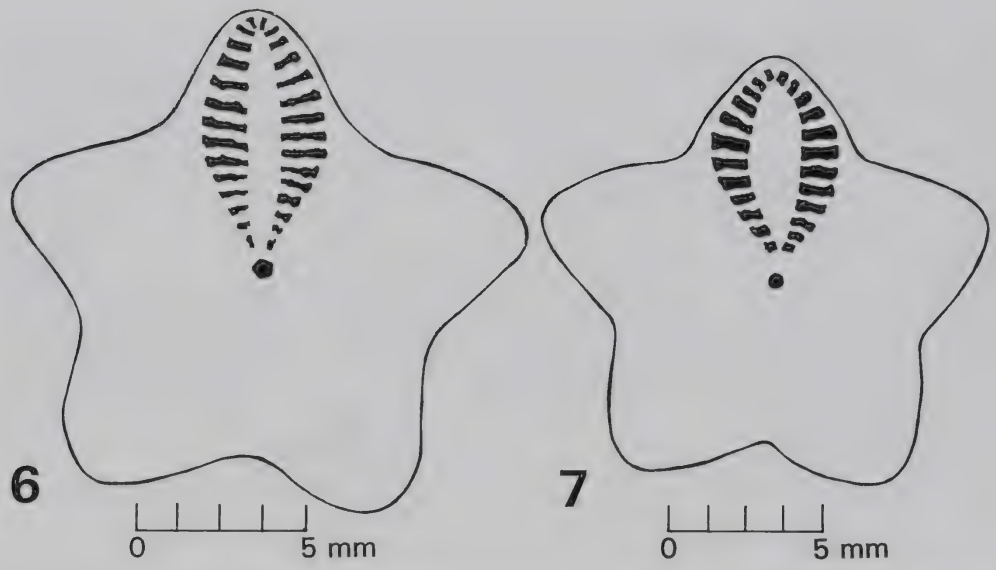
Table 1. Measurements (mm) and meristics of the columnals of eight specimens of *Nielsenicrinus waiteteensis* n.sp.

Specimens	AK 71631	AK 71632	AK 71633	AK 71634	AK 71635	AK 71636	E 518	E 519
Greatest inter-radial length	4.2	3.9	3.9	4.0	4.0	4.3	4.0	4.3
Greatest radial length	3.3	3.0	3.2	3.1	3.3	3.1	3.1	3.1
Inter-nodal height	1.1	0.5-1.4	1.2	1.9	1.1	1.2-1.7	2.0	2.2
Nodal height	–	2.7	–	–	–	–	–	–
Mean no. of peripheral crenullae per section	14	–	12	13	13	13	13	12
Mean no. of radial crenullae per section	14	–	14	13	13	13	13	14

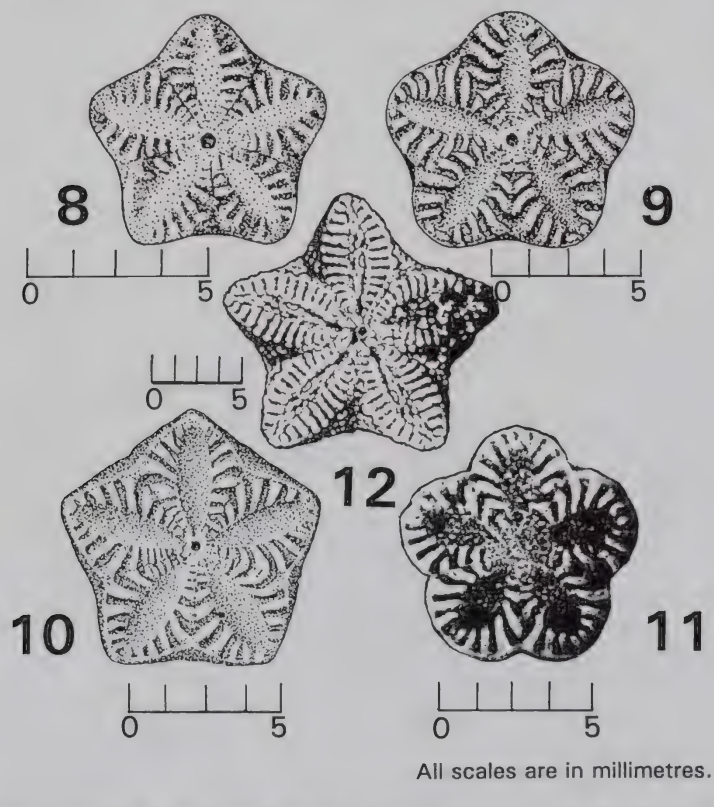
Figs. 2-3. *Nielsenicrinus waiteteensis* n.sp., Duntroonian stage, Torehina Formation, Waitete Bay, Coromandel. 2. Proximal view of the internodal articular face of the holotype AK71631. 3. Nodal elliptical cirral socket showing circular axial pore and fulcral ridge of the paratype AK71632.



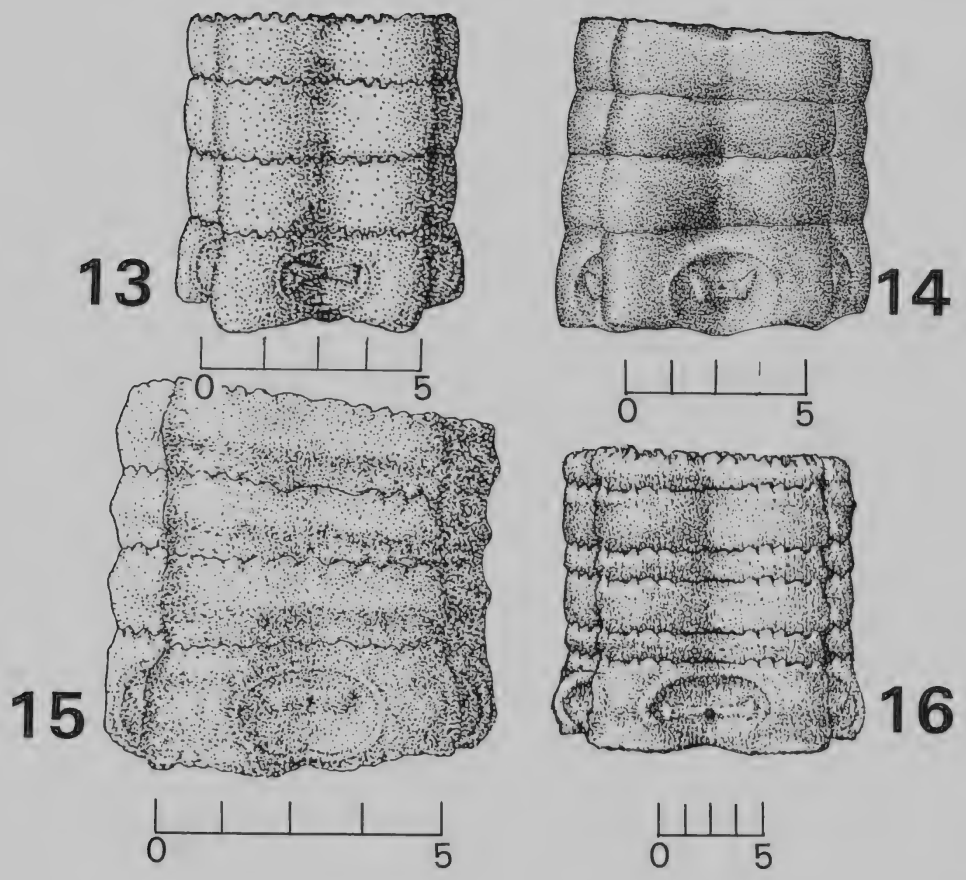
Figs. 4-5. Comparable proximal articular faces. 4. Composite line drawing of the articular face of an internodal of *Nielsenicrinus waiteteensis* n.sp., paratype AK71633 from limestone at Waitete Bay, Coromandel. 5. Line drawing of the articular face of an internodal of *Pentacrinus stellatus* from Point Elizabeth Beach, Westland, South Island.



Figs. 6-7. Internodal articular face comparison of the petal, areolae, and number of culimina. 6. *Nielsenicrinus waiteteensis* n.sp. 7. *Pentacrinus stellatus.*



Figs. 8-12. Comparable proximal articular faces of *Nielsenicrinus* spp. 8. *N. obsoletus.* 9. *N. cretaceus.* 10. *N. rosenkrantzi.* 11. *N. varians.* 12. *N. waiteteensis* n.sp. (8-10 after Rasmussen 1961; 11 from Klikushin 1982.)



Figs. 13-16. Comparable lateral views of pluricolumnal stems of *Nielsenicrinus* spp. 13. *N. obsoletus*. 14. *N. cretaceus*. 15. *N. rosenkrantzi*. 16. *N. waiteteensis* n.sp. (13-15 after Rasmussen 1961.)

radial area exists between petals, in from the periphery. Axial canal narrow, sub-pentagonal. Lumen contained within a narrow, raised ridge, continued in the adradial crenulation. Perilumen interrupted, smooth. Nodals slightly higher and often more robust than internodals. Nodal and internodal surfaces are smooth and slightly tumid. Articulation between nodal and infranodal cryptosymplectical. Cirrus sockets elliptical and cover most of nodal height. Upper margin of cirrus socket protruding. Cirrus axial canal sited slightly above socket middle beneath an articular ridge with enlarged tubercle ends. Internodal length unknown. Cirri, theca, brachials, and pinnules also unknown.

ETYMOLOGY

Named after the type locality, Waitete Bay.

FAUNAL ASSOCIATIONS

McKay (1897), Park (1897), Fraser & Adams (1907), Kear (1955) and Skinner (1969) list fossil macrofauna from the limestone of Waitete Bay. Eagle and Hayward (1993) provide a paleontological and paleoenvironmental assessment of the macrofauna found at this fossil locality. All taxa appear *in-situ.*

DISCUSSION

Columnal descriptions of *Nielsenicrinus* spp. by Rasmussen (1961) show the proximal internodal articular face of the type specimen of *Nielsenicrinus obsoletus* (Nielsen, 1913) (Figs. 8, 13; Mineralogical and Geological Museum of Copenhagen no. 8884, Upper Danian age, recovered at the base of the Paleogene at Svanemollen in Copenhagen, Denmark) to be the most similar to specimens of the Torehina Formation of Waitete Bay. Of similar columnal shape, the main differences are that *Nielsenicrinus waiteteensis* n.sp. possesses: narrower culimina of greater length about the gradual transition from marginal to adradial position; greater number of culimina per petal (26-28 compared with 18-20); narrower petal areolae; and a much larger inter-radial space. Morphological comparison with other species of the genus shows that: *Nielsenicrinus cretaceus* (Leymerie, 1842) (Figs. 9, 14; Geological Survey, London, no. 1577, from the Cenomanian Grey Chalk, Folkstone, England), possesses no inter-radial spaces, has fewer culimina per petal (14-18), and culimina are aborally uneven. *Nielsenicrinus rosenkrantzi* Rasmussen, 1961 (Figs. 10, 15; Mineralogical and Geological Museum of Copenhagen no. 8882, Maastrichtian, Stevens Klint, Denmark), possesses reduced inter-radial spaces, has merging petal culimina, fewer culimina per petal (20-23), and is elliptically broader in petallic areolae. *Nielsenicrinus varians* Klikushin, 1980 (Fig. 11; Leningrad Mining Institute no. KM-7-3, Danian, Mangyshlack, Crimea), is more pentalobate in shape, marginal culmina are wider, culimina petalicly interwoven, with fewer culimina per petal (12-16), and a circular lumen.

The calyx of *Nielsenicrinus waiteteensis* is unknown. Lack of preservation may be due to predation by fish while live, or scavenging at death by epifaunal or infaunal organisms (Maples & Archer 1989). The stalk probably extended to a length of 0.6-1.5 m. The recovery of only mature columnal ossicles must be considered in light of the fact that stalks of extant isocrinids continue to grow and shed terminal columnals. The discovery of pluricolumnals, however, does not support the concept of ontogenetically discarded distal ossicles in this species, and would suggest death *in-situ.* Because of similarities to European *Nielsenicrinus* species, it is suggested that *N. waiteteensis* is a Cenozoic remnant of a Tethyan fauna that migrated to New Zealand before or during the Cretaceous.

The presence of a benthic, semi-sessile invertebrate such as *Nielsenicrinus* in a shallow inner-shelf environment of late Paleogene age conflicts with the findings of Meyer & Macurda (1977). In their discussion of the adaptive radiation of comatulid crinoids (mobile feather stars), they state that stalked articulate crinoids disappeared globally from shallow-water environments in the mid to late Mesozoic. Bottjer & Jablonski (1988) corroborate this trend, further stating that isocrinids became restricted to middle-shelf and deeper environments during the late Cretaceous and further restricted to outer-shelf and deeper environments in the Eocene, retaining this environmental distribution to the present. There are, however, a few references to Cenozoic isocrinids found in shallow-water strata (late Oligocene, Germany

(Kutscher 1980); late Paleocene, New Jersey (Weller 1907; Greacen 1941)). All Isocrinida enjoyed a wide environmental range in the Early Cretaceous. It appears that *Nielsenicrinus waiteteensis* was able to persist at the earlier shallow depth in the late Oligocene, Duntroonian Stage.

It has been proved that extant pelmatozoan crinoids (stalked, sessile sea lilies) occur at variable depths and in a wide range of marine habitats (Agassiz 1888). Isocrinids occur today on a wide variety of substrates (Messing 1984). It is suggested that they were, as they are now, numerically important members of several benthic hard and soft ground assemblages (Bourseau & Roux 1984). Some genera have distinct bathymetric ranges of several hundred metres at least, whereas others have depth ranges of little more than 50 m. Although no evidence of an anchoring mechanism such as a holdfast, terminal rootlets, or expanded columnal base (as described by Clark (1977)) has been found, this is not a prerequisite for any isocrinid to attach and live on a lithified substrate or an unconsolidated surface (Messing 1984), nor does it mean that *N. waiteteensis* did not possess such mechanisms.

Compared to other fossil isocrinids the columnals of *Nielsenicrinus waiteteensis* are particularly large. The inclusion of a calcareous skeleton such as that within *Nielsenicrinus* produces a self-sustaining growth advantage, and it seems that *Nielsenicrinus waiteteensis* used this factor to increase stem area two-fold. Larger stem columnals have meant an overall increase in stem area which has also increased by the adoption of a dense stellate stem ossicle shape. These factors have produced a third more surface area for support and structural strength compared with many other members of the subclass Articulata. This development would require a constant, rich source of nutrient to facilitate proportional growth. It is possible that *Nielsenicrinus waiteteensis* was partitioning available (otherwise locally unused) food resources to help in this. Ausich (1980) has already proposed that this was a reality for multi-tiered assemblages of fossil crinoids such as isocrinids, however, it is also apparent from other fossil faunas collected (Eagle & Hayward 1993) that the temperate, inner-shelf biotope at Waitete Bay was at least moderately nutrient-rich.

Acknowledgements. Thanks are due to Bruce Hayward (Auckland Institute and Museum) for suggesting that I write the paper and for his excellent company and knowledge in the field; to Krzysztof Pfeiffer (Auckland Institute and Museum) for photography and processing (Figs. 1 and 2); to Jack Grant-Mackie (University of Auckland) and Hugh Grenfell (Auckland Institute and Museum), for guidance and critical appraisal of the manuscript; to Jenny Riley for laying out Table 1. Field work was financed by the Worth Fund of the Auckland Institute and Museum.

REFERENCES

AGASSIZ, A.

1888 Three cruises of the U.S. Coast and Geodetic Survey Steamer "Blake" in the Gulf of Mexico, in the Carribbean Sea, and along the Atlantic coast of the United States from 1877 to 1880. *Bulletin of the Museum of Comparative Zoology, Harvard* 14, 15.

AUSICH, W.I.

1980 A model for niche diferentiation in Lower Mississipian crinoid communities. *Journal of Paleontology* 54:273-288.

BATHER, F.A.
1917 The Triassic crinoids of New Zealand. *Geological Society of London, Quarterly Journal* 78:247-256.

BOTTJER, D.J. and D.J. JABLONSKI
1988 Paleoenvironment patterns in the evolution of post-Paleozoic benthic marine invertebrates. *Palaios* 3(6):540-560.

BOURSEAU, J.P. and M. ROUX
1984 Bathymetrie et variabilite morphologique chez les Pentacrinidae (Echinodermes- Crinoides pedoncules) du Pacifique occidental. Pp. 175-180. *In:* Keegan, B.F. and B.D.S. O'Connor (eds.). *Echinodermata Proceedings of Fifth International Echinoderm Conference, Galway, 1984. Balkema, Rotterdam.*

CLARK, A.M.
1977 Notes on deep-water Atlantic Crinoidea. *Bulletin of the British Museum (Natural History), Zoology* 31(4):159-186.

DONOVAN, S.
1984 Stem morphology of the recent crinoid *Chladocrinus (Neocrinus) decorus. Paleontology* 27:825-841.
1987 Fossils explained. 7: Crinoid columnals. *Geology Today, May-June:*100-101.
1988 Functional morphology of synarthrial articulations in the crinoid stem. *Lethaia* 21(2):169-176.

EAGLE, M.K. and B.W. HAYWARD
1993 Oligocene paleontology and paleoecology of Waitete Bay, Northern Coromandel Peninsula. *Records of the Auckland Institute and Museum* 30:13-26.

FRASER, C. and J.H. ADAMS
1907 The geology of the Coromandel Subdivision, Hauraki, Auckland. *New Zealand Geological Survey Bulletin* 4:1-154.

GREACEN, K.F.
1941 The stratigraphy, fauna, and correlation of the Vincetown Formation. *New Jersey Department of Conservation, Geology Series, Bulletin* 52:1-83.

HUTTON, F.W.
1873 *Catalogue of Tertiary Mollusca and Echinodermata of New Zealand, with Diagnoses of the Species.* Colonial Museum and Geological Survey Department, Wellington.

KEAR, D.
1955 Mesozoic and lower Tertiary stratigraphy and limestone deposits, Torehina, Coromandel. *New Zealand Journal of Science and Technology* 37b:107-114.

KLIKUSHIN, V.G.
1979 Microstructural features of Isocrinid stems. *Paleontology Journal 1* (translated): 83-90.
1982 Taxonomic survey of fossil isocrinids with a list of the species found in the U.S.S.R. *Geobios* 15(3):299-325.

KUTSCHER, M.
1980 Die Echinodermen des Oberoligozans von Sternberg. *Zeitschrift fur geologische Wissenschaften, Berlin* 10:221-239.

McKAY, A.
1897 Report on the Geology of the Cape Colville Peninsula, Auckland. *New Zealand Parliamentary Papers* C9:1-75.

MacLAREN, J.M.
1900 Geology of the Coromandel Goldfields. *New Zealand Mines Reports* C9:1-75.

MAPLES, C.G. and A.W. ARCHER
1989 Paleoecological and sedimentological significance of bioturbated crinoid calyces. *Palaios* 4:379-383.

MESSING, C.G.
1984 Brooding and paedomorphosis in the deep-water feather star *Comatilia iridometriformis* A.H. Clark (Echinodermata: Crinoidea). *Marine Biology, Berlin* 80:83-91.

MEYER, D.L. and D.B. MACURDA
1977 Adaptive radiation of the comatulid crinoids. *Palobiology* 3:74-82.

MOORE, R.C.
1939 The use of fragmentary crinoidal remains in stratigraphic paleontology. *Journal of Scientific Laboratories, Denison University* 33:165-250.

MOORE, R.C. and H.E. VOKES
1953 Lower Tertiary crinoids from Northwestern Oregon. *United States Geological Survey Professional Papers* 233-E:113-148.

MOORE, R.C., R.M. JEFFORDS and T.H. MILLAR
1968 Morphological features of crinoid columnals. *Paleontological Contributions University of Kansas, Echinodermata, Articulata* 8:1-30.

PARK, J.
1897 The geology and veins of the Hauraki Goldfields, New Zealand, with Maps and Sections. *Transactions of the New Zealand Institute of Mining Engineers* 1:1-105.

RASMUSSEN, H.W.
1961 A Monograph on the Cretaceous Crinoidea. *Biologiska Skrifter udgivet af Det Kongelige Danske Videnskabermes Selskab Bind* 12(1&2):1-428.
1978 Articulata. Pp. 813-928. *In:* Moore, R.C. and C. Teichert (eds.). *Treatise on Invertebrate Paleontology. Part T, Echinodermata* 2(3). Geological Society of America and University of Kansas. Boulder, Colorado and Lawrence, Kansas.

ROUX, M.
1977 The stalked joints of recent Isocrinidae (Crinoidea). *Bulletin of the British Museum (Natural History), Zoology* 32(3):45-64.

SIMMS, M.J.
1988 The Phylogeny of post-Palaeozoic crinoids. *In:* C.R.C. Paul & A.B. Smith (eds.). *Echinoderm Phylogeny and Evolutionary Biology.* Oxford University Press, Oxford.

SKINNER, D.N.B.
1969 Colville Formation, a new formation possibly correlative with the Waitemata Group. *New Zealand Journal of Geology and Geophysics* 12(2):349-360.

STUKALINA, G.A.
1988 Studies in Paleozoic crinoid-columnals and -stems. *Palaeontographica Abt. A.* 204(1-3):1-66.

UBAGHS, G.
1978 Skeletal morphology of fossil crinoids. Pp. 58-216. *In:* Moore, R.C. and C. Teichert (eds.). *Treatise on Invertebrate Paleontology. Part T, Echinodermata* 2(1). Geological Society of America and University of Kansas. Boulder, Colorado and Lawrence, Kansas.

WEBSTER, G.D.
1974 Crinoidal pluricolumnal nodotaxis patterns. *Journal of Paleontology* 48:1283-1288.

WELLER, S.
1907 A report on the Cretaceous of New Jersey. *Geological Survey of New Jersey, Paleontology Series* 4:1-87.

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OLIGOCENE PALEONTOLOGY AND PALEOECOLOGY OF WAITETE BAY, NORTHERN COROMANDEL PENINSULA

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Abstract. Thirty-nine macrofossil taxa are recorded from the late Oligocene (Duntroonian to mid Waitakian) Torehina Formation at Waitete Bay, northern Coromandel Peninsula. A rich fauna dominated by infaunal suspension-feeding bivalves occurs in 25-30 m of calcareous siltstone and fine sandstone in the middle of the formation. Also recorded from this unit are 42 species of foraminiferal microfossils (3-5% planktic forms) from three faunal samples. Both macro and microfossils indicate accumulation in a sheltered marine environment at deep inner shelf depths (20-50 m).

A low diversity macrofauna, containing a mixture of soft sediment and hard substrate dwelling forms, occurs in sandy flaggy limestone in the upper part of the Torehina Formation. This fauna is also inferred to have lived at deep inner shelf depths on a sandy seabed where patches of lithified bioclastic sandstone was developing.

These fossil-based paleoenvironmental assessments indicate that the Torehina Formation was deposited during an interval in which sea level was raised or the area subsided 80-90 m.

PREVIOUS WORK

The geology of northern Coromandel Peninsula, in the vicinity of Waitete Bay was mapped by Fraser and Adams (1907), Kear (1955) and Skinner (1976). As early as 1886, the best exposures of middle Cenozoic sediments on the Coromandel Peninsula had been discovered and described from this area by Alexander McKay (1886).

McKay (1897), Park (1897), Maclaren (1900) and Fraser and Adams (1907) recorded the essential elements of the meagre fossil fauna within the sequence - unidentified bryozoa and foraminifera, one species each of echinoid, crinoid and fish, four species of bivalve and two of gastropods. Hayward *et al.* (1990) recorded a fossil reef coral head found within the sequence at Waitete Bay by Phil Moore. Eagle (1993) describes a new species of crinoid from the collections that we discuss in this paper. Fraser and Adams (1907) named the sequence Torehine Series and presented the first detailed description of the stratigraphy. Brothers and Mason (1954) presented stratigraphic columns for the sequence and Kear (1955) produced a detailed map of their distribution in the hills to the east.

The early workers thought the Torehina rocks to be early Eocene, but foraminiferal studies by Finlay and Hornibrook (in Brothers and Mason 1954, and Kear 1955) assigned them to a late Oligocene (Duntroonian or Duntroonian to Waitakian) age.

GEOLOGY (Fig. 1)

The northern end of the Coromandel Peninsula is essentially composed of Jurassic Manaia Hill Group greywacke basement overlain and intruded by Miocene and Pliocene Coromandel and Whitianga Group calc-alkaline volcanic and plutonic rocks (Skinner 1976). In several places, small outcrops of middle Tertiary sedimentary rocks are preserved between the Mesozoic basement and overlying Neogene volcanics. Two of these outcrops are early Miocene Colville Formation sequences that immediately predate the start of volcanism (Skinner 1969). The remaining outcrops are of thin late Oligocene Torehina Formation sequences (Kear 1955, Skinner 1976). The thickest and best exposed Oligocene outcrops occur in coastal exposures at Waitete Bay and in inland exposures in the adjacent hills to the east (Fig. 1).

In this paper, we focus on the paleontology of two Torehina Formation outcrop blocks - one exposed in the cliffs and banks around Waitete Bay (S10/289010) and the other exposed in recent road cuttings on the Coromandel-Colville Road half-way up the hill east of Waitete Bay (T10/301006). Measured stratigraphic columns for the section in each outcrop block are given in Fig. 1.

Both outcrop blocks have similar sequences, with an irregular greywacke surface overlain by:
(a) 0-12 m or more of massive to weakly stratified sandy, clast-supported, cobbly, pebbly, greywacke conglomerate with occasional fossil log moulds. Lenses and stringers of laminated fine to coarse, carbonaceous sandstone occur sporadically throughout the conglomerate unit, together with irregular, thin lignite laminae.

In the road cuttings this conglomerate unit passes conformably up into:
(b) 25-30 m of massive to weakly bedded, calcareous siltstone and muddy very fine sandstone. This unit is slightly carbonaceous in its lower parts and has several slightly sandier horizons containing common turritellid gastropods, large oysters and sporadic concretions around the fossils or sometimes around burrow systems.

In the Waitete Bay coastal exposures the siltstone unit is conformably overlain by:
(c) 7 m of massive to flaggy, weakly bedded, fine to medium sandy limestone, with a distinctive, 2 m thick, fossil-rich horizon of flaggy limestone 2 m above its base.

The top of the sequence has probably been removed by erosion as there is an unconformity and time gap between the Torehina Formation and the overlying Coromandel Group terrestrial volcanic rocks.

In this paper, we provide the first updated list of the macrofauna since Fraser and Adams (1907), a foraminiferal species list, and the first interpretation of the paleoenvironment as provided by the fossil faunas.

Fossil Record Numbers are those of the New Zealand Fossil Record File (prefixed by S10/f or T10/f). All macrofossils (except the coral head) are held in the collections of Auckland Institute and Museum and all microfossils are held by the Institute of Geological and Nuclear Sciences, Lower Hutt.

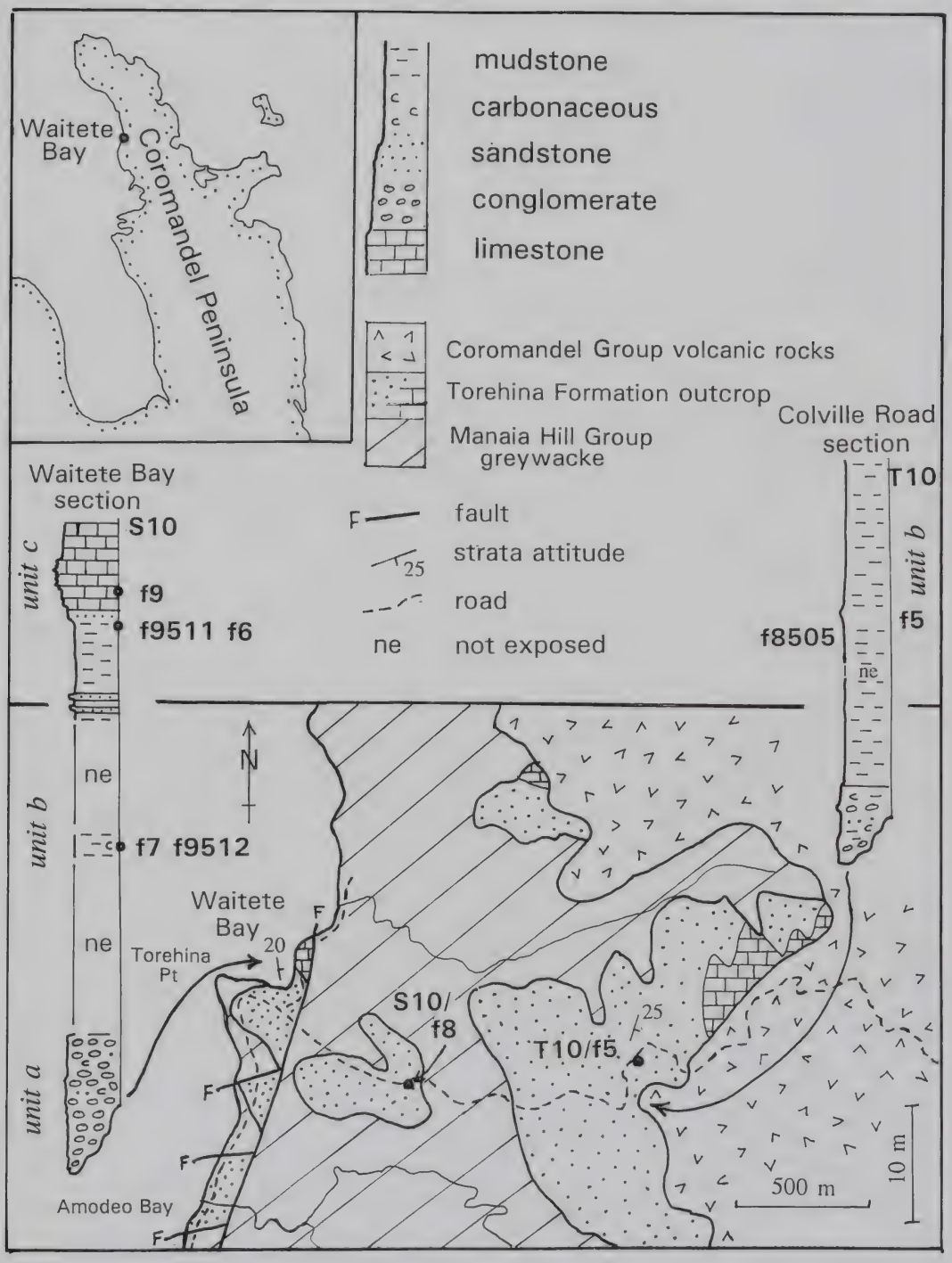

Fig. 1. Geological map of the Waitete Bay area of northern Coromandel Peninsula, after Kear (1955) and Skinner (1976), with stratigraphic columns for the Oligocene Torehina Formation at Waitete Bay and the Coromandel-Colville road section.

MACROFAUNA

All collected taxa are listed in Appendix 1. The paleontological and paleoenvironmental assessment that follows is largely based on the known ecology of genera living today and of modern species most closely related to these fossils.

INNER SHELF SILT AND SAND COMMUNITY, 10-50 m (Fig. 2)
S10/f6, S10/f7, S10/f8, T10/f5

The sparse fossil macrofauna collected from the calcareous siltstone unit at Waitete Bay and in Colville Road cuttings consists of decalcified, broken and disarticulated specimens.

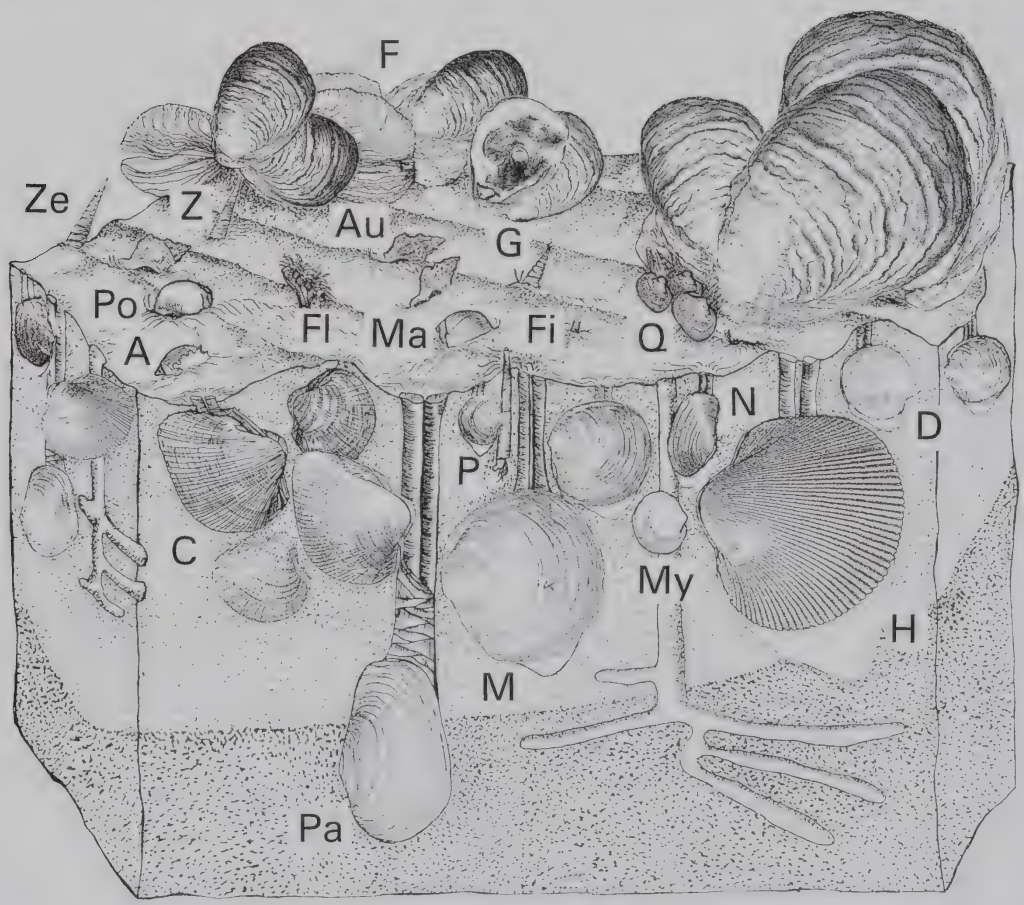

Fig. 2. Schematic drawing of the Waitete Bay *in-situ* Inner Shelf Silt and Sand Community (10-50 m). A= *Amalda (Baryspira)* cf. *pristina;* Au= *Austrofusus (Neocola) demissus;* C= *Cucullaea (Latiarca) worthingtoni;* D= *Dosinia (Austrodosinia) sodalis;* F= *Flemingostrea wollastoni;* Fi= *Fissidentalium solidum;* Fl= *Flabellum distinctum;* G= *Gazameda grindleyi;* H= *Hedecardium (Hedecardium) waitakiense;* M= *Miltha neozelanica;* Ma= *Magnatica (Magnatica) planispira;* My= *Myrtea staminifera;* N= *Neilo sinangula;* P= *Pteromyrtea auriculata;* Pa= *Panopea worthingtoni;* Po= *Polinices (Polinella) blaesus;* Q= *Quadrilatera* cf. *januaria;* Z= *Zeacolpus keari;* Ze= *Zeacolpus wharekuriensis.* No scale implied.

Decalcification of specimens is due to prolonged leaching and weathering. Minor pre-burial transport probably accounts for both breakage and disarticulation. The macrofauna occurs in silty, glauconitic horizons, veneered with rippled, fine-grained sand.

The depositional environment of this fossil assemblage is inferred to have been a sheltered bay with a paleo water depth of probably not more than 50 m. The biotope is interpreted as being below fairweather wave base, and above normal storm wave base, with fossils common in storm beds with parallel laminae or hummocky cross-stratification interbedded with fairweather fine-grained beds. The community lived epifaunally and infaunally in silt and fine glauconitic sand with the underlying Mesozoic bedrock providing the occasional, isolated, natural holdfast.

Like many Cenozoic fossil communities, it was dominated numerically by shallow-burrowing, suspension-feeding bivalves such as the most abundant fossil in this biotope, *Dosinia sodalis*. An important element was the large lucinid bivalve *Miltha neozelanica* which typically inhabited shellbeds in soft shallow marine substrates such as this. The smaller, more fragile bivalves *Myrtea* and *Pteromyrtea* are also present, as is the large, heavy *Cucullaea worthingtoni* which lacked a bysuss and lived freely in the silt and sand.

The epifaunal arcoid bivalve *Quadrilatera* cf. *januaria* probably preferred a hard substrate such as dead mollusc shells or greywacke rocks for byssal attachment. Also present was the deep burrower, the long-siphonate and sedentary, suspension-feeding *Panopea worthingtoni*. Like the living species *P. zelandica* (Morton and Miller 1968) this precursor probably burrowed 0.7 m or more into the soft sand.

The presence of the deposit feeder *Neilo sinangula* is suggestive of quieter water in the deeper parts of the inner shelf (>30 m), as living *Neilo* does not occur in the shallows. Another deposit feeding bivalve in this community was the large endemic *Hedecardium waitakiense* with its inflated thin shell.

Also common are specimens of the large oyster *Flemingostrea wollastoni*. This giant of its family almost certainly attached itself flat against exposed rock, or they lightly "welded" themselves to each other in well-oriented clusters, raised above the level of the silty seafloor. Many of these fossil oyster shells are bored by worms and sponges, indicating that these organisms were also active in this paleoenvironment. The head of a hermatypic coral *Leptastrea* is inferred to have been one of many scattered heads growing on the seafloor among the giant oysters.

Of the fossil gastropods present, the deposit-feeding turritellids *Gazameda grindleyi*, *Zeacolpus keari* and *Zeacolpus wharekuriensis* are common and probably lived on wide, sandy expanses at these inner shelf depths. Also ranging this open and exposed environment were the naticids *Magnatica planispira* and *Polinices blaesus*. Like their carnivorous descendents, both probably preyed upon burrowing bivalves.

Other minor members of this community were the infaunal scaphopod *Fissidentalium* and the ahermatypic coral, *Flabellum distinctum*, which probably attached itself to dead shells or nestled in the soft sediment. Several calcite tubes attest to the presence of the serpulid *Protula*.

Bioturbation and trace fossils are prevalent, indicating that a far greater variety of soft-bodied organisms lived in this community than fossil preservation provides evidence for.

INNER SHELF BIOCLASTIC SAND LITHOHERM COMMUNITY, 10-50 m (Fig. 3) S10/f9

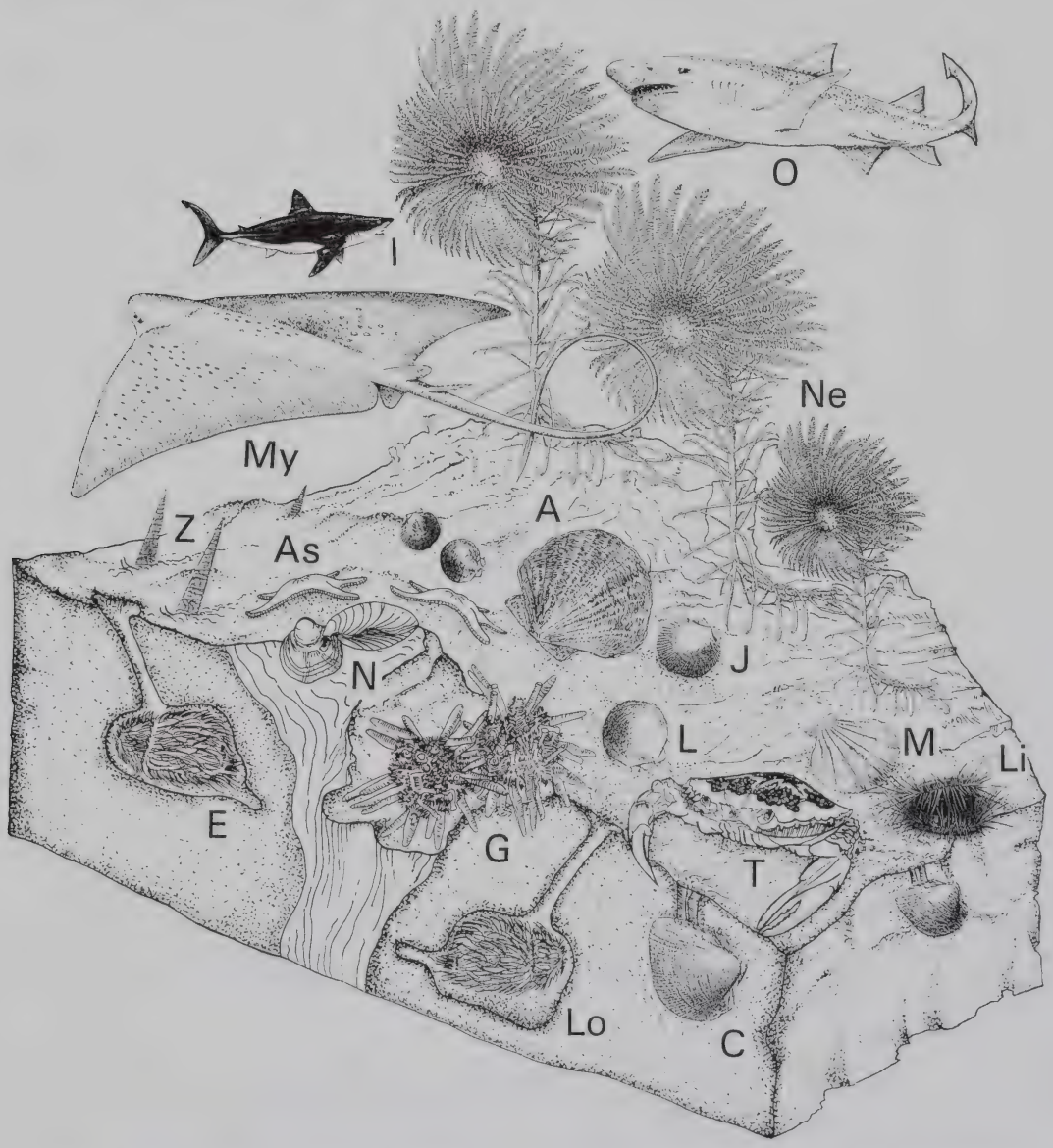

Fig. 3. Schematic drawing of the Waitete Bay *in-situ* Inner Shelf Bioclastic Sand and Lithoherm Community (10-50 m). A= *Althlopecten athleta;* As= asteroid sp.; C= *Cucullaea (Latiarca) worthingtoni;* E= *Eupatagus rostratus zitteli;* G= *Goniocidaris hebe;* I= *Isurus hastalis;* J= *Janupecten uttleyi;* L= *Lentipecten hochstetteri;* Li= *Lima paleata;* Lo= *Lovenia tuberculata;* M= *Mesopeplum burnetti;* My= *Myliobatis plicatilis;* N= *Neothyris* cf. *novara;* Ne= *Nielsenicrinus waiteteensis*; O= *Odontaspis elegans;* T= *Tumidocarcinus* cf. *tumidus;* Z= *Zeacolpus* sp. No scale implied.

A low diversity fossil macrofauna occurs in the sandy flaggy limestone at Waitete Bay. It is a mixture of mollusc, echinoderm, brachiopod, crab and shark remains. Some elements of the fauna would have lived in a soft sandy substrate and others require a hard substrate or crevices as a habitat. As no greywacke pebbles have been found in the limestone here, we suggest that a greywacke rock outcrop nearby is less likely than the development on the sea-floor of patches of lithified bioclastic sandstone (=lithoherm) surrounded by unlithified sand.

The bivalve *Cucullaea worthingtoni* and gastropod *Zeacolpus keari* probably inhabited the sandy areas of this community. There are four pectenid bivalves present: the large free-swimming, *Athlopecten athleta;* the smooth-shelled *Lentipecten hochstetteri;* the discordantly-sculptured, sessile *Janupecten uttleyi*; and the most common species, the strongly costate *Mesopeplum burnetti.* They would have lived on both the lithified and unlithified substrates. Another freely mobile bivalve present is *Lima paleata,* which was probably able both to swim and crawl, like the modern New Zealand *Lima colorata zelandica.*

Brachiopods were also part of this community. The radially ribbed *Magasella* cf. *sanguinea* and smooth valved, globular, *Neothyris* cf. *novara* would have attached by pedicle to any dead shell, exposed rock or pebble. Echinoderms are represented by spatangoid and cidarid echinoids, an asteroid, and an isocrinid crinoid. Two cosmopolitan spatangoid genera are represented: *Lovenia* and *Eupatagus.* They are characteristic infaunal dwellers, and probably dug themselves many centimetres into the soft substrate by the movement of their lateral spines.

Fossil interambulacral plates show that the cosmopolitan, cidarid *Goniocidaris* existed in this community. It probably lived nestled in cracks, under ledges or in cavities in the lithoherm, as does the recent New Zealand *G. umbraculum.* Starfish are natural prehensile predators of bivalves. It is not surprising then that a large starfish (asteroid) ossicle should be found in an environment populated by pectenids.

Nielsenicrinus waiteteensis is a typical semi-sessile, benthic isocrinid which probably lived attached to the lithoherm where weak currents provided both food and oxygen to the passive filter-feeders. Although crinoids are extremely rare at inner shelf depths, much of the rest of the fossil fauna is indicative of inner shelf depths of 10-50 m.

A chela of the crab *Tumidocarcinus* cf. *tumidus* is the only evidence of any crustacea. The crab probably resided in narrow crevices or beneath stones, feeding on worms, isopods, amphipods and some molluscs. Scattered evidence of the necktonic fauna that swam freely overhead is provided by several fossil teeth of the lamnid sand sharks *Odontaspis elegans* and *Isurus hastalis* and by a partial crushing plate of the eagle ray, *Myliobatis plicatilis.* The fauna described above probably lived amongst hydroids, seaweeds, annelids, sponges and tunicates, none of which is usually fossilised.

RARE OR UNUSAL TAXA

The Waitete Bay fossil fauna contains the rare bivalve *Miltha neozelanica.* This large extinct mollusc is a cosmopolitan taxon characteristic of a shallow, nearshore, soft substrate (Beu *et al.* 1990). Another bivalve, the byssally-attached, endemic, warm-water arcoid *Quadrilatera januaria* has been recorded from late Eocene to middle Oligocene (Kaiatan to

Whaingaroan stages) rocks, mainly at South Island localities. Two poor specimens referrable to this species were found in late Oligocene rocks at Waitete Bay. This range extension may be due to preferred paleoenvironmental conditions.

The head of the coral *Leptastrea* is to date the only record of hermatypic (reef-building) corals in the New Zealand Oligocene (Hayward *et al.* 1990). Numerous coral heads and pieces, but no reefs, are known from the slightly younger early Miocene of northern New Zealand (Hayward 1977a). It is unusual to find crinoids in such shallow, inner shelf depths today or in the Tertiary. Thus the presence in this rich deposit of fossil remains of a new isocrinid species *Nielsenicrinus waiteteensis* (Eagle 1993) is of considerable interest. Crinoids disarticulate readily at death and are often transported some distance with resulting abrasion making the skeletal remains unidentifiable. To recover identifiable crinoid components *insitu* as at Waitete Bay is also unusual. The partial mouth crushing plate of an eagle ray is a rare find.

MICROFAUNA

Of nine sediment samples taken from the Torehina Formation and processed for foraminiferal microfaunas over the last 45 years, three were found to contain rich, moderately preserved faunas. Two samples come from the bottom (S10/f9512) and the top (S10/f9511) of the calcareous siltstone unit at Waitete Bay and the third sample (T10/f8505) from the middle of the siltstone in the Coromandel to Colville Road section (Fig. 1). Several other more sparse and poorly preserved microfaunas had essentially similar composition to the three rich faunas. No foraminiferal microfaunas have been obtained from the carbonaceous conglomerate unit nor from the extremely hard, cemented limestone unit. The three rich microfaunas were repicked, fully identified and percentage abundance estimates were obtained for planktics and the different benthic species (Appendix 2).

In all three samples, planktics comprise only 3-5% of the foraminifera, a character suggestive of neritic water conditions most usually in a sheltered environment at inner shelf depths (Hayward 1986).

The benthic faunas are dominated by a combination of *Notorotalia spinosa, Arenodosaria antipoda, Cibicides* spp., *Melonis* spp. and *Gyroidina allani* with a number of less abundant species. This combination of dominant species is considered to be characteristic of sheltered, muddy, inner shelf depths in the Oligocene and late Eocene around New Zealand (Hayward 1986). The fauna lacks any restricted deeper water taxa, but also none or very few of the taxa that usually dominate beach and high energy subtidal (0-20 m depth) environments of this age, such as *Cibicides notocenicus,* glabratellids, miliolids, discorbids, *Amphistegina* and *Elphidium.* The microfaunas are essentially the same as assemblage (b) from the late Eocene and Oligocene of Northland (Hayward 1985), which would have lived in a low energy, sheltered, muddy environment at deeper inner shelf depths (20-50 m).

AGE

MACROFAUNAL EVIDENCE

The presence of the molluscs *Janupecten uttleyi* (Ar-Ld), *Athlopecten athleta* (Ld-Lw), *Magnatica (Magnatica) planispira* (Ld-Pl), *Gazameda grindleyi* (Ld-Lw), the cidarid

Goniocidaris hebe (Ld-Pl) and the crab *Tumidocarcinus* cf. *tumidus* (Lwh-Ld) in the Waitete Bay fauna gives a late Oligocene (Duntroonian, Ld) age. This record of the arcoid genus *Quadrilatera* extends its time range beyond the Whaingaroan into the Duntroonian.

MICROFAUNAL EVIDENCE

There are few age-diagnostic foraminifera present in these Torehina Formation samples. The presence of *Notorotalia spinosa* (Ld-Pl) and *Globigerina euapertura* (Lwh-mLw) give a definite late Oligocene age (Duntroonian to middle Waitakian, Ld-mLw). One specimen of *Rectuvigerina* intermediate between *R. rerensis* (Lw-Sc) and *R. striatissima* (Lwh-Ld) suggests that the age may be close to the Duntroonian-Waitakian boundary.

When combined, the macrofaunal and microfaunal evidence support a late Oligocene, Duntroonian age.

PALEOENVIRONMENT AND PALEOGEOGRAPHY

No marine macro or microfossils have been found in the basal conglomerate (unit a, Fig. 1). It appears to have a non-marine fluvial or alluvial origin. All the microfaunas and most of the macrofauna have been recovered from the calcareous siltstone and fine sandstone (unit b) that overlies the conglomerate. There is no observable change in the fossil content throughout the 25-30 m thickness of this unit. The macrofauna and foraminiferal microfaunas together support an inferred sheltered environment at deep inner shelf depths (20-50 m). The presence of some areas of solid greywacke rock nearby is inferred from the macrofauna.

The overlying sandy limestone (unit c) contains a low diversity macrofauna in its lower parts that indicates continued inner shelf depths. Some elements of the fauna would have lived on a hard substrate or within cracks and crevices within it. We infer the development of a patchwork of lithified bioclastic sandstone on the seafloor at this time.

The approximately 50 m thickness of this Torehina Formation sedimentary sequence documents an interval of raised sea level or slow subsidence in the late Oligocene of the northern Coromandel. Paleo water depths do not appear to have exceeded 50 m and thus the amount of raised sea level or subsidence is unlikely to have exceeded 100 m (accounting for the accumulation of 50 m of sediment) and may have been closer to 80-90 m.

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REFERENCES

BEU, A.G., P.A. MAXWELL and R.C. BRAZIER
1990 Cenozoic Mollusca of New Zealand. *New Zealand Geological Survey Paleontological Bulletin* 58.

BROTHERS, R.N. and A.P. MASON
1954 The Torehine beds of Coromandel Peninsula. *Records of the Auckland Institute and Museum* 4: 193-198.

BUCKERIDGE, J.S.
1983 Fossil barnacles (Cirripedia: Thoracica) of New Zealand and Australia. *New Zealand Geological Survey Paleontological Bulletin* 50.

CHAPMAN, F.
1918 Descriptions and revisions of the Cretaceous and Tertiary fish-remains of New Zealand. *New Zealand Geological Survey Paleontological Bulletin* 7.

DAWSON, E.W.
1990 The Cenozoic Brachiopoda of New Zealand: a commentary, reference list, and bibliography. *New Zealand Oceanographic Institute Miscellaneous Publication* 103.

EAGLE, M.K.
1993 A new fossil isocrinid crinoid from the late Oligocene of Waitete Bay, northern Coromandel. *Records of the Auckland Institute and Museum* 30:1-12.

FELDMANN, R.M. and I.W. KEYES
1992 Systematic and stratigraphic review with catalogue and locality index of the Mesozoic and Cenozoic decapod Crustacea of New Zealand. *New Zealand Geological Survey Record* 45.

FELL, H.B.
1954 Tertiary and Recent Echinoidea of New Zealand. Cidaridae. *New Zealand Geological Survey Paleontological Bulletin* 23.

FLEMING, C.A.
1971 A preliminary list of New Zealand fossil polychaetes. *New Zealand Journal of Geology and Geophysics* 14(4): 742-756.

FOSTER, B.A.
1978 The marine fauna of New Zealand: barnacles (Cirripedia: Thoracica). *New Zealand Oceanographic Institute Memoir* 69.

FRASER, C. and J.H. ADAMS
1907 The geology of the Coromandel Subdivision, Hauraki, Auckland. *New Zealand Geological Survey Bulletin* 4.

HAYWARD, B.W.
1977a Lower Miocene corals from the Waitakere Ranges, North Auckland, New Zealand. *Journal of the Royal Society of New Zealand* 7: 99-111.
1977b Lower Miocene polychaetes from the Waitakere Ranges, North Auckland, New Zealand. *Journal of the Roya Society of New Zealand* 7(1): 5-16.
1985 Foraminiferal biostratigraphy and faunal assemblages of east Northland coal exploration boreholes 1982-1983. *New Zealand Geological Survey Report Pal* 93.
1986 A guide to paleoenvironmental assessment using New Zealand Cenozoic foraminiferal faunas. *New Zealand Geological Survey Report Pal* 109.

HAYWARD, B.W., P.R. MOORE and G.W. GIBSON
1990 How warm was the Oligocene in New Zealand? Coconuts, reef corals and larger foraminifera. *Geological Society of New Zealand Newsletter* 90: 39-41.

HENDERSON, R.A.
1975 Cenozoic spatangoid echinoids from New Zealand. *New Zealand Geological Survey Paleontological Bulletin* 46.

HORNIBROOK, N.deB., C.P. STRONG and R.C. BRAZIER
1989 Manual of New Zealand Permian to Pleistocene foraminiferal biostratigraphy. *New Zealand Geological Survey Paleontological Bulletin* 56.

KEAR, D.
1955 Mesozoic and lower Tertiary stratigraphy and limestone deposits, Torehina, Coromandel. *New Zealand Journal of Science and Technology* 37B: 107-114.

McKAY, A.
1886 The geology of Cabbage Bay District, Cape Colville Peninsula. *Reports of the Geological Survey of New Zealand* 1885: 192.
1897 Report on the geology of the Cape Colville Peninsula, Auckland. *New Zealand Parliamentary Papers* C9: 1-75.

MacLAREN, J.M.
1900 Geology of the Coromandel Goldfields. *New Zealand Mines Reports C9.*

MORTON, J.E. and M.C. MILLER
1968 The New Zealand Seashore. Collins, Auckland.

PARK, J.
1897 The geology and veins of the Hauraki Goldfields, New Zealand, with maps and sections. *Transactions of the New Zealand Institute of Mining Engineers* 1: 1-105.

SKINNER, D.N.B.
1969 Colville Formation - a new formation possibly correlative with the Waitemata Group. *New Zealand Journal of Geology and Geophysics* 12: 349-360.
1976 Sheet N40 and part sheets N35, N36 and N39 Northern Coromandel (1st edition). "Geological Map of New Zealand 1: 63 360". *New Zealand Department of Scientific and Industrial Research, Wellington.*

SQUIRES, D.F.
1958 The Cretaceous and Tertiary corals of New Zealand. *New Zealand Geological Survey Paleontological Bulletin* 29.
1962 Additional Cretaceous and Tertiary corals from New Zealand. *Transactions of the Royal Society of New Zealand, Geology* 1(9): 133-150.

VICKERS-RICH, P., J.M. MONAGHAN, R.F. BAIRD, and T.H. RICH (eds.)
1991 *Vertebrate Palaeontology of Australasia.* Monash University, Melbourne.

M.K. EAGLE and B.W. HAYWARD, Auckland Institute and Museum, Private Bag 92018, Auckland.

APPENDIX 1. Systematic list of macrofauna tabulated from the Waitete Bay inner shelf silt and sand community (S) and inner shelf bioclastic sand and lithoherm community (L) localities. Taxonomy follows Beu *et al.* (1990) for mollusca; Dawson (1990) for brachiopods; Foster (1978) and Buckeridge (1983) for barnacles; Chapman (1918) and Vickers-Rich *et al.* (1991) for chondrichthyans; Henderson (1975) for spatangoid echinoids; Fell (1954) for cidarids; Feldmann and Keyes (1992) for decapod crustacea; Fleming (1971) and Hayward (1977b) for polychaeta; and Squires (1958, 1962) for corals.

S = SILTSTONE AND FINE SANDSTONE UNIT
S10/f6 Waitete Bay, north end, beneath limestone, S10/289010
S10/f7 Waitete Bay, south end, at stream mouth, S10/288009
S10/f8 Colville Road, 800 m up from Torehina Point, S10/296006
T10/f5 Colville Road, 1.3 km up from Torehina Point, T10/302007

L = LIMESTONE UNIT
S10/f9 Waitete Bay, north end, S10/289010

	MOLLUSCA BIVALVIA	
MALLETIIDAE	*Neilo sinangula* Finlay, 1926	S
NOETIIDAE	*Quadrilatera* cf. *januaria* (Marwick, 1926)	S
CUCULLAEIDAE	*Cucullaea (Latiarca) worthingtoni* Hutton, 1873	S
PECTENIDAE	*Athlopecten athleta* (Zittel, 1864)	L
	Janupecten uttleyi (Marwick, 1924)	L
	Lentipecten hochstetteri (Zittel, 1864)	L
	Mesopeplum burnetti (Zittel, 1864)	L
LIMIDAE	*Lima paleata* Hutton, 1873	L
OSTREIDAE	*Flemingostrea wollastoni* (Finlay, 1927)	S
LUCINDAE	*Miltha neozelanica* Marshall & Murdoch, 1921	S
	Myrtea staminifera (Marwick, 1929)	S
	Pteromyrtea auriculata (Bartrum, 1919)	S
CARDIIDAE	*Hedecardium (Hedecardium) waitakiense* (Suter, 1907)	S
	Dosinia (Austrodosinia) sodalis Marwick, 1929	S
HIATELLIDAE	*Panopea worthingtoni* Hutton, 1873	S
	GASTROPODA	
TURRITELLIDAE	*Gazameda grindleyi* (Marwick, 1971)	S
	Zeacolpus keari Marwick, 1971	S
	Zeacolpus wharekuriensis Marwick, 1971	S
NATICIDAE	*Magnatica (Magnatica) planispira* (Suter, 1917)	S
	Polinices (Polinella) blaesus Marwick, 1929	S
OLIVIDAE	*Amalda (Baryspira)* cf. *pristina* (Olson, 1956)	S
BUCCINIDAE	*Austrofusus (Neocola) demissus* Marwick, 1931	S
	SCAPHOPODA	
DENTALIIDAE	*Fissidentalium solidum* (Hutton, 1873)	S

	BRACHIOPODA	
DALLINIDAE	*Magasella* cf. *sanguinea* (Leach, 1814)	L
	Neothyris cf. *novara* (von Ihering, 1903)	L
	ECHINODERMATA ASTEROIDEA	
	ossicle, gen. et sp. indet.	L
	ECHINOIDEA	
CIDARIDAE	*Goniocidaris hebe* Fell, 1954	L
	SPATANGOIDEA	
LOVENIIDAE	*Lovenia tuberculata* (Zittel, 1864)	L
BRISSIDAE	*Eupatagus rostratus zitteli* Henderson, 1975	L
	CRINOIDEA	
ISOCRINIDAE	*Nielsenicrinus waiteteensis* Eagle, 1993	L
	CHONDRICHTHYES	
LAMNIDAE	*Isurus hastalis* Agassiz, 1843	L
	Odontaspis elegans Agassiz, 1843	L
MYLIOBATIDAE	*Myliobatis plicatilis* Davis, 1888	L
	CRUSTACEA DECAPODA	
XANTHIDAE	*Tumidocarcinus* cf. *tumidus* (Woodward, 1876)	L
	CIRRIPEDIA	
ARCHAEOBALANIDAE	*Tasmanobalanus acutus* (Withers, 1924)	L
	POLYCHAETA	
SERPULIDE	*Protula* cf. *tubularia* (Montagu, 1803)	S
	COELENTERATA	
FLABELLIDAE	*Flabellum distinctum* Milne-Edwards & Haime, 1848	S
FAVIIDAE	*Leptastrea* sp.	S
	BRYOZOA	
	gen. et sp. indet.	L

APPENDIX 2. List of foraminifera obtained from northern Coromandel Peninsula Oligocene samples. Numbers are abundances (%) in each sample (1-3). Asterisk signifies present but not recorded in quantitative pick. Taxonomy follows Hornibrook *et al.* (1989).

1 S10/f9512 Waitete Bay, S10/288009
2 S10/f9511 Waitete Bay, S10/289010
3 T10/f8505 Coromandel-Colville Road, T10/301006

	1	2	3
Benthics:			
Amphistegina sp.			3
Anomalinoides awamoana			*
Anomalinoides subnonionoides			1
Arenodosaria antipoda	23	5	15
Astrononion parki			*
Bulimina pupula	3		6
Cancris lateralis			1
Cibicides maculosa	5		
Cibicides perforatus			1
Cibicides temperatus		25	7
Cribrorotalia dorreeni	1		
Cribrorotalia longwoodensis			*
Cyclammina incisa			1
Dentalina obliquecostata	1		
Dentalina soluta			1
Discorbis scopos	3		9
Dorothia minima	3		
Elphidium gibsoni			*
Globocassidulina pseudocrassa			1
Globocassidulina subglobosa	1		
Guttulina fissurata	3		9
Gyroidina allani	12		17
Gyroidina prominula			2
Gyroidina subzelandica			1
Haplophragmoides sp.			*
Haeuslerella textilariformis	1		
Lenticulina loculosa	3		3
Marginulinopsis allani	6		*
Melonis dorreeni	3		
Melonis maoricum	3		4
Melonis simplex		25	
Notorotalia spinosa	22	35	12
Pararotalia mackayi	1		
Pseudopolymorphina parri			*
Pullenia quinqueloba	1		
Rectuvigerina rerensis x *striatissima*		1	
Saracenaria arcuatula	1		
Semivulvulina waitakia	1		1
Sigmoidina sp.			*
Sphaeroidina bulloides	5		4
Planktics:			
Globigerina euapertura	3	5	2
Globigerina labiacrassata			1

DESCRIPTIONS AND REDESCRIPTIONS OF LANDSNAILS (MOLLUSCA: PUNCTIDAE) IN THE GENERA *PHRIXGNATHUS* AND *TAGUAHELIX*

F.M. CLIMO* AND J.F. GOULSTONE**

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Abstract. Types of *Phrixgnathus francesci* Webster, 1904 and *Phrixgnathus elaiodes* Webster, 1904 contain more than one species in each case and lectotypes are here selected in line with the author's original description. Both species are transferred to the genus *Taguahelix* Powell, 1955. Two new species, *Phrixgnathus douglasi* and *Taguahelix crispata*, are described. These snails have been confused in the past with the Webster species. *Phrixgnathus brunneus* is also described, a species which A.E. Brookes intended naming about 1930, having selected prospective types from the Bay of Plenty.

This paper finishes work started by two early collectors. The Rev. W.H. Webster described several species of small landsnails and A.E. Brookes intended to describe new species for his tubes of "types" with names have been found in the Auckland Museum collections.

Most of Webster's type material contained many specimens without a holotype being nominated. In this paper we reconsider the type series of *Phrixgnathus francesci* Webster, 1904 and *Phrixgnathus elaiodes* Webster, 1904. The descriptions, however, which Webster gave did not wholly satisfy the characteristics of any one snail in the material offered. In 1987 F.M. Climo tentatively selected lectotypes and paralectotypes for the two species which offered the closest fit to the author's description but never published this information. Since then the Auckland Museum landsnail collection has been reviewed and re-housed by J.F. Goulstone and nothing has come to light in the Webster lots to contradict Climo's choices of lectotype. It seems appropriate now to redescribe the two Webster species and also two others which have previously been confused with them, and which indeed may have confused Webster himself.

The other snail here described, *Phrixgnathus brunneus*, comes from the collections of the late A.E. Brookes which are held in the Auckland Museum and include about 80 specimens from the Motu River, Bay of Plenty. Other specimens have also emerged from Brookes' bulk location lots which he had not separated. Again, it seems a fitting time to finalise an action he failed to complete about 1930.

We have used *Taguahelix* Powell, 1955 at a generic level to contain three of these species because they seemed to fall naturally within the genus typified by *Taguahelix campbellicus*

(Filhol). Powell (1955) included certain shells with hair-like processes from the sub-antarctic islands within the genus but we feel they would be better placed elsewhere. Climo (1992) discusses *Taguahelix* in a wider context and suggests better groupings for these other species. The remaining two we have left in *Phrixgnathus*, as a holding group until their proper affinities can be ascertained.

Distribution details have been included in the text for relevant specimens held in Auckland Museum and the Museum of New Zealand. Maps also show this information, though somewhat abridged.

The following names which occur frequently, particularly in the distribution sections, are referred to by initials only: A.E. Brookes, F.M. Climo, J.F. Goulstone, B.F. Hazelwood, P. Mayhill, D.J. Roscoe, W.H. Webster. Auckland Museum = AK. Museum of New Zealand = MNZ. Map references refer to the NZMS 260 series.

SYSTEMATICS

FAMILY: PUNCTIDAE Morse, 1864
GENUS: *TAGUAHELIX* Powell, 1955

TYPE SPECIES: *Thermia expeditionis* Suter, 1909 = *Helix campbellica* Filhol, 1880

Shells unicoloured, light horny, yellow or greenish, depressed helicoid or depressed turbinate with elaborate sculpture of numerous irregular axials or wrinkles, at times faint but often extended and crisp, on a surface pattern of dense microscopic spiral threads. Protoconch relatively large, low, rounded, sculptured with exceedingly fine dense spiral striations.

Taguahelix elaiodes (Webster, 1904) Figs. 1-4

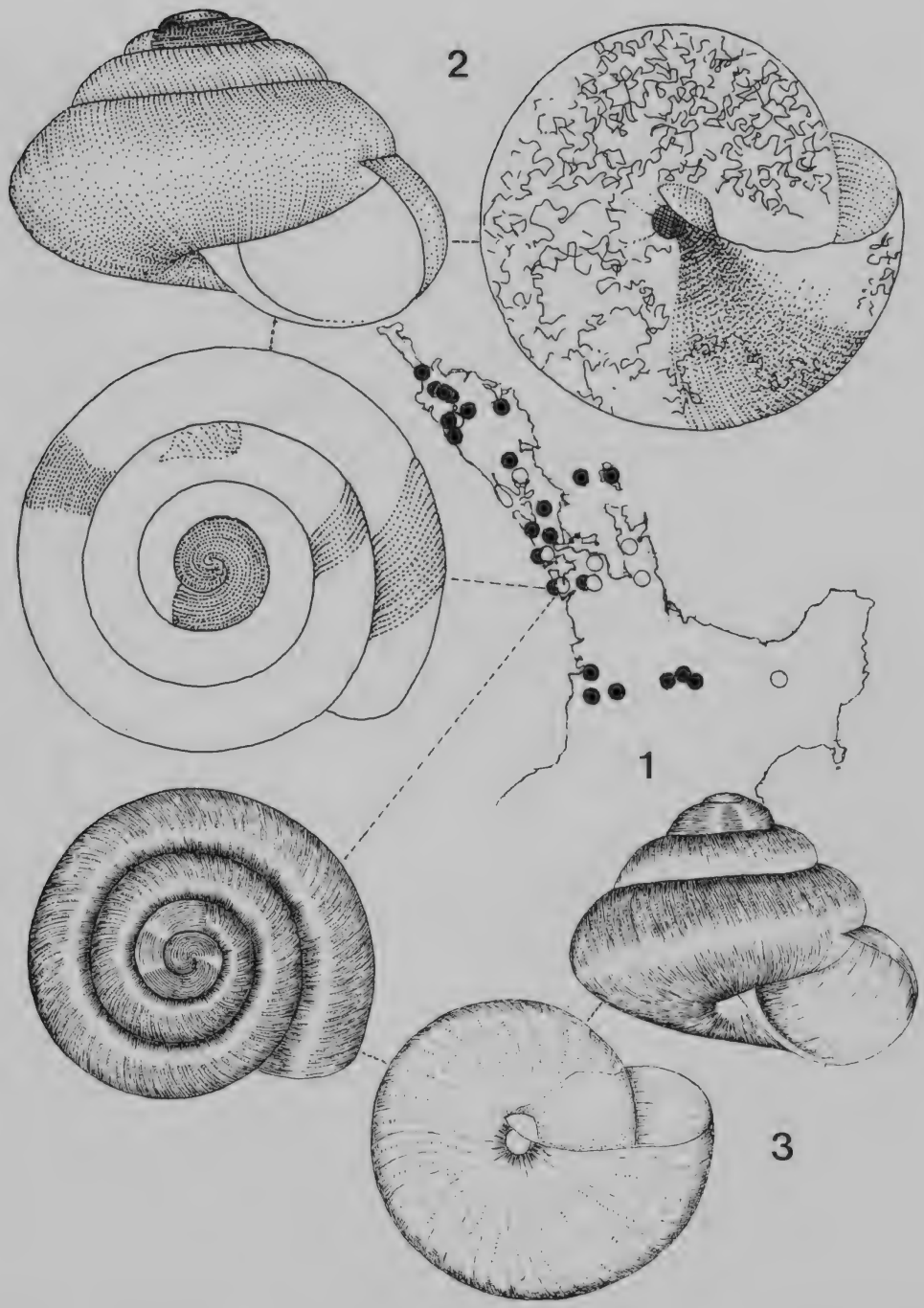
Synonymy: *Phrixgnathus elaiodes* Webster, 1904: 106 in part; Suter 1913: 744 in part (Suter used the wrong illustration). *Laoma (Phrixgnathus) elaiodes* Powell, 1979: 327. *'Paralaoma'* n.sp.33 Solem, Climo & Roscoe 1981: 479. Ballance 1982: 31. Punctid n.sp.33 Goulstone 1983: 45, 1990: 40. *Taguahelix* (n.subgen.1) *elaiodes* Climo 1992: 35.

DESCRIPTION

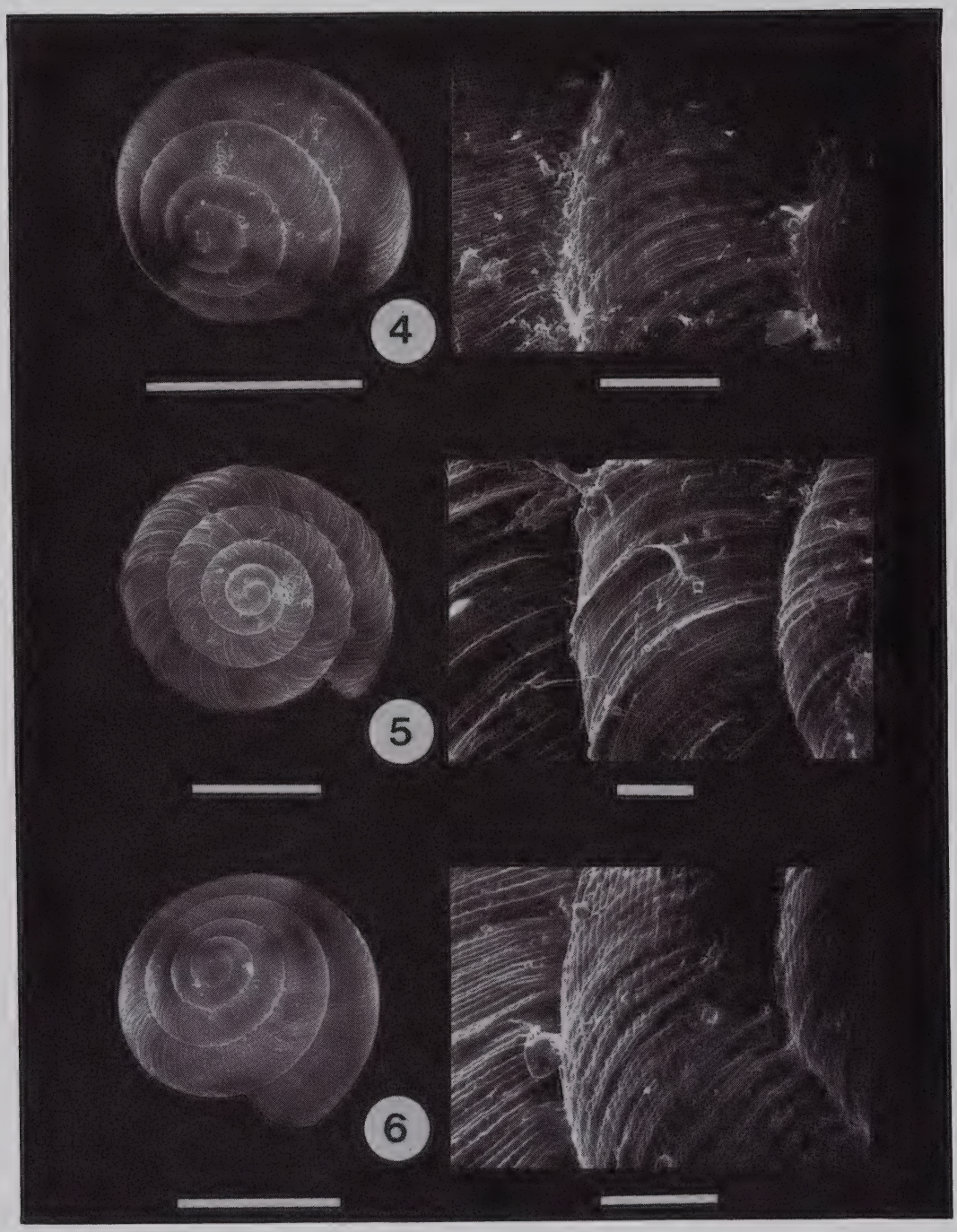
Shell small, turbinate, olive green, sub-perforate, finely concentrically striate, these striations also prominent on the succeeding whorls. The post embryonic whorls also have fine radial sculpture, very faint on the base. This sculpture in places on some shells shows a pattern of wider stronger primary ribs but seems to be random. However, all the ribbing is at a microscopic level and the shell even with 10x magnification appears nearly smooth. Protoconch 1.25 whorls. Total whorls 3.75; periphery and base rounded. Suture deep. Collumella oblique, reflexed to slightly cover the narrow umbilicus.

REMARKS

There were two tubes of types, one labelled "Types" the other "Co-types". The "Types" tube (T.M.384), examined by F.M. Climo in 1987, contained seven specimens comprising three specimens of *Taguahelix elaiodes* Webster (AK 70384, MNZ M115631); one specimen



Figs. 1-3. *Taguahelix elaiodes*. 1. Geographic distribution. Solid dots are records from the Museum of New Zealand; open dots are records from the Auckland Museum. 2. Waiuku, 1.5 mm x 1.2 mm (lectotype AK 70384). 3. Waiuku, 1.4 mm x 1.2 mm (paralectotype AK 71557).



Figs. 4-6. Scanning electron photomicrographs. 4. *Taguahelix elaiodes*, Waiuku (paralectotype AK 71582). 5. *Taguahelix crispata*, Titirangi, A.E.B. 11/30 (AK 79620). 6. *Taguahelix* n.sp., Scenic Drive, Waitakere Ranges, A.E.B. (AK 79621). Scale lines: left 1 mm, right 0.1 mm.

of Punctid n.sp.3 Climo ms. (AK 79434); one specimen of Punctid n.sp.29 Climo ms. (AK 79436); and two specimens of Punctid n.sp.32 Climo ms. (AK 79435).

The co-type tube found by J.F. Goulstone in 1992 contained five specimens comprising one paralectotype of *Taguahelix elaiodes* Webster (Fig. 4, AK 71582); two specimens of *Taguahelix viridula* (Suter, 1909) (AK 79510); and two specimens of Punctid n.sp.32 (AK 79435). Other material collected by Webster and labelled *P. elaiodes* contained in addition to the above, *Taguahelix crispata* n.sp.

Webster mentions ribs at 10 per mm in his type description and these are hard to find except the somewhat random occurrence mentioned in the description. It seems he was describing features on several species for, though *T. elaiodes* Webster is always a difficult shell to identify because of its lack of strong features, all the specimens we have seen have shown uniformity.

Also lacking strong features is Punctid n.sp.32 which is a similar size and shape but shinier, smoother and lighter coloured and this is the species most often found together with *T. elaiodes* in Webster's material. It could also be confused with a juvenile *Taguahelix crispata* n.sp., and particularly a similar new species discussed later (Figs. 6,9), though these are larger with stronger sculpture. The numbered Punctids are illustrated in Goulstone (1983, 1990).

TYPE LOCALITY: Waiuku

LECTOTYPE: Auckland Museum, AK 70384 (width 1.5 mm, height 1.2 mm).

PARALECTOTYPES (3): AK 71557, AK 71582, MNZ M115631. AK 70384, AK 71557 and MNZ M115631 are from the original "Type" tube (T.M.384) from Waiuku. AK 71582 is from the "Co-type" tube also from Waiuku.

HABITAT

Little known for the snail never seems common and few live ones are seen. Several specimens were found in rimu (*Dacrydium cupressinum*) litter.

DISTRIBUTION

Mangatete Reserve, P.M. 12/83, MNZ M82449. North Mangamuka Gorge, D.J.R. 30/12/78, MNZ M61905. Warrawarra South, Maungataniwha, O05/371436, P.M. 1/90, MNZ M101638. Tutamoe Walkway, P.M. 9/84, MNZ M31795. Waima Forest, Mountain Rd., O06/515345, J.F.G. 5/90, AK. Kaikohe, A.C. O'Connor, 1935, MNZ M25294. Waiotemarama State Forest, P.M. 11/86, MNZ M98253. Northern Waipoua Forest, N. Gardner, 9/68, MNZ M29531. Waipoua Forest, 5 km S of 'Tane Mahuta', B.F.H. 6/10/76, MNZ M55446. Mangatu State Forest, Tikehore Rd., B.F.H. 6/3/77, MNZ M55771. Pukeiti State Forest, Manginangina turnoff, P05/824686, D.J.R. 27/12/78, MNZ M104269. Punaruku, upper ridges in litter, R. Parrish, 15/10/87, MNZ M99078. Mt. Hirakimata summit, Great Barrier Island, F.M. O'Brien, 15/4/66, MNZ M57644. Little Barrier Island, A. Ballance, 8/81, MNZ M77449. Little Barrier Island: J. Cochrane, MNZ M79520; Tirikanawa, P.M. 8/83, MNZ M79402.

Waipu Caves Rd., limestone, B.F.H. 9/9/84, MNZ M80213. Omeru Reserve, B.F.H. & H. Taylor, 20/4/87, MNZ M99574. Woodcocks, Kawa Reserve, B.F.H. 28/9/83, MNZ M78872. Dome Valley, start of Waiwhiu Conical Pk. Rd., B.F.H. 8/9/84, MNZ M80253. Kaukapakapa Scenic Reserve, P.M. 9/85, MNZ M82939. Coromandel-Kuaotuna Rd., N. Douglas, 8/1/69, AK. Thames, Kauaeranga Valley, T12/459542, J.F.G. 1/79, AK. North Shore, Paremoremo, D.J.R. 26/12/77, MNZ M83501. Waitakere Ranges: Cornwallis, 20/5/27, AK; Titirangi, A.E.B. AK; Scenic Drive, Mrs. D. Hole, 20/6/74, AK; Fairy Falls, Q11/486754, J.F.G. 9/82, AK; Walkers Bush, R11/513770, J.F.G. 1/78, AK; Huia Dam Q11/484695, J.F.G. 11/11/90, AK; Walkers Bush, rimu litter, B.F.H. 26/9/83, MNZ M80417; Spraggs Bush, under logs, B.F.H. 26/9/83, MNZ M88285; Henderson, B.F.H. 26/9/83, MNZ M75871; Titirangi, J.F.G. 1982, MNZ M79594; Swanson, Pukematekeo summit, B.F.H. 26/9/83, MNZ M80363. Hunua Ranges: Wairoa Dam, S12/987528, J.F.G. 8/79, AK; Mangatawhiri, J.F.G. 1975, MNZ M54237. Manukau Peninsula: Wattle Bay, R11/512606, N. Douglas, 24/2/74, AK; Awhitu Gully, F.M.C. 15/2/81, MNZ M78479. Pukekohe, Rooseville Park, R12/804429, J.F.G. 10/85, AK. Kawhia: Whenuapo, Bluff deposit, Hamilton Junior Naturalists Club, 1970-72, MNZ M45877; Te Kauri Park, Andersons Bluff, P. Parkinson, 11/68, MNZ M48094; Te Kauri Park, under log, B.F.H. 15/8/77, MNZ M69871. Waitomo: Waitomo System, Catacomb Cave, Hamilton Junior Naturalists Club 1970-72, MNZ M83502; S end Mahoe Rd., B.F.H. 13/11/77, MNZ M73292, & 11/9/84, MNZ M76406; Paryphanta Cave, Hamilton Junior Naturalists Club, 1970-72, MNZ M83496; cave entrance, F.M.C. 18/2/81, MNZ M77553; Piripiri, Bluff deposit, Natural Bridge, Hamilton Junior Naturalists Club, 1970-72, MNZ M83500. Tokoroa, Pukerimu Reserve, under logs, B.F.H. MNZ M68131. Mamaku, W18/644694, D.J.R. 13/12/72, MNZ M31795. Rotorua, C. Broomfield, 1978, MNZ M61575. Mt. Ngongotaha summit, B.F.H. 2/9/78, MNZ M58223. Ureweras, Waikare River, W17/620973, J.F.G. 5/79, AK.

Taguahelix crispata n. sp. Figs. 5, 7-8

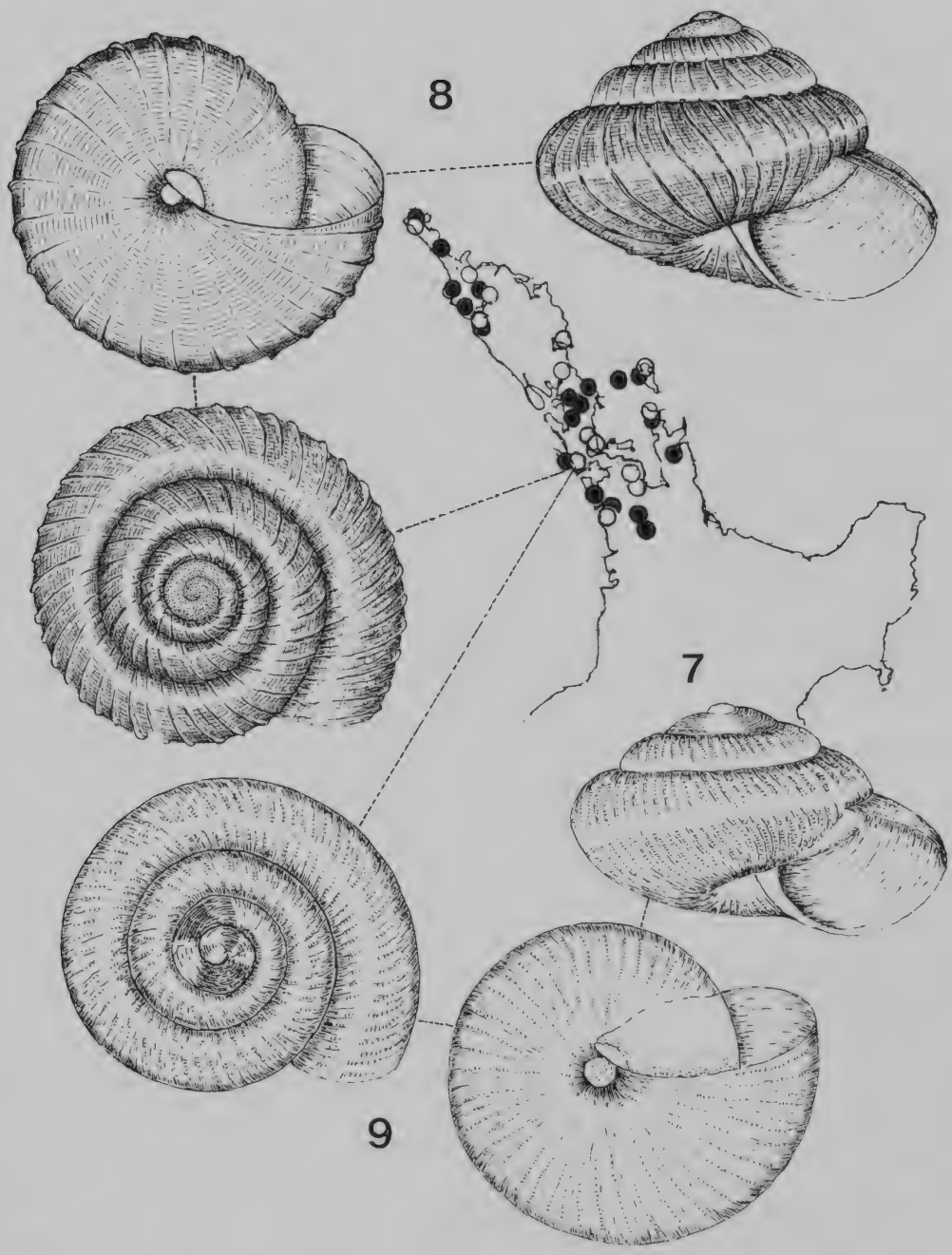
Synonymy: '*Phrixgnathus*' *elaiodes* Solem, Climo & Roscoe 1981: 478. Punctid n.sp.17 Goulstone 1983: 43, 1990: 40; Goulstone, Mayhill & Parrish 1993: 17. *Taguahelix* (s.s.) n.sp.1 Climo 1992: 23.

DESCRIPTION

Shell small, turbinate, slightly compressed with 4.25 whorls. Protoconch of 1.75 whorls with very faint spiral striations, though on the rest of the shell they are prominent. Post embryonic whorls with prominent, irregular radial periostracal processes, facing backwards, about 30-40 on the final whorl of an adult specimen, with similar finer ribbing in between. The main ribs are quite solid based and in some specimens produced into thin sharp blades. If these processes are worn off the shell appears with quite solid ridges. This strong ribbing extends a little onto the base then muted radial and spiral striae exhibit about equal prominence. Umbilicus is open though narrow and partly covered by the reflexed columella. Colour golden in fresh shells.

REMARKS

This snail has a handsome prominent shell, overlooked by earlier collectors, so that very



Figs. 7-9. *Taguahelix crispata* and *Taguahelix* n.sp. 7. Geographic distribution of *Taguahelix crispata*. Solid dots are records from the Museum of New Zealand; open dots are records from the Auckland Museum. 8. *Taguahelix crispata*, Titirangi, Waitakere Ranges, 2.5 mm x 1.9 mm (holotype AK 71558). 9. *Taguahelix* n.sp., Piha Rd., Waitakere Ranges, 1.5 mm x 1 mm (AK 79622).

few specimens are present in the Auckland Museum collection. It is not plentiful in the Waitakeres.

There is one undescribed species which could be mistaken for *T. crispata* and though it needs further evaluation we have figured it here (Figs. 6,9). It has a more depressed shell and its ribbing is not so pronounced, more akin to that of *T. viridula*, though without the accelerated final whorl. The two species occurred together in the type location R11/581720, Titirangi.

TYPE LOCALITY: Titirangi, Waitakere Ranges, R11/581720.

HOLOTYPE: Auckland Museum, AK 71558 (width 2.5 mm, height 1.9 mm), Atkinson Reserve, Titirangi, under an old rimu, J.F.G. 4/92.

PARATYPES (4): AK 71559, Huia Dam, Waitakere Ranges, Q11/484695, J.F.G. 9/82. MNZ M11562 (3 specimens), Laingholm, Waitakere Ranges, R11/568691, J.F.G. 11/82.

HABITAT

This species prefers an aerial habitat and has been found on trunks under bark and in living nikau (*Rhopalostylis sapida*) boles as well as on the ground. A tree platform in the Waitakeres 10 m off the ground yielded a remarkable number of species including *T. crispata* (Goulstone 1992).

DISTRIBUTION

Te Paki: Radar Bush, N02/891477, J.F.G. 11/5/91, AK & P.M. 5/82, MNZ M74347; Waterfall Gully B.F.H. 3/1/76, MNZ M48654; Unuwhao, P.M. 4/83, MNZ M79020; Waterfall Gully, D.J.R. 3/1/76, MNZ M115625 & 30/12/78, MNZ M83494; Haupatoto Bush, N02/068488, R. Parrish, 17/3/88, MNZ M96558; Unuwhao, N02/009519, C. Ogle et al. 9/86, MNZ M87895; Radar Bush, alluvial tce. by stream, C. Ogle et al. 11 /86, MNZ M87860; Ngaruariki Stream N02/034531, C. Ogle et al. 11/86, MNZ M87806. Parengarenga: Head of Paingatai Channel, N02/0634 94, P. Anderson, S. Carlin & C. Ogle, 6/3/85, MNZ M77134 & Head of Waimanana Stm. N02/077455, 6/3/85, MNZ M83492. Ahipara: Hunahuna catchment P.M. 1/90, MNZ M101671 & Waitaha catchment, 11/87, MNZ M98796. 1.6 km S from Mangamuka turnoff towards Kohukohu, P.M. 10/78, MNZ M62524. Puketi State Forest, P.M. 9/84, MNZ M83139. Warrawarra State Forest: P.M. 10/78, MNZ M62551; South, Maungataniwha, O05/371436, P.M. 1/90, MNZ M101651; North, P.M. 10/86, MNZ M97243. Hokianga, Motukaraka Scenic Reserve, O05/525494, J.F.G. 5/90, AK. Hokianga, Opononi, W. LaRoche, AK. Motutoa midden, C. Fredericksen, 1989, MNZ M97506. Manganui: Pekerau, A.E.B. AK; Oruru, A.E.B. AK. Ngunguru, P.M. 9/78, MNZ M58123. Whangarei Heads, A.E.B. 25/11/51, AK. Waipu Gorge, Falls Track, B.F.H. 4/91, AK. Kaukapakapa Scenic Reserve, P.M. 9/85, MNZ M82934. Warkworth: Woodcocks Rd. P.M. 8/78, MNZ M63202; nikau litter behind Bob Penniket's house, R09/ 055290, B.F.H. 3/3/85, MNZ M76564; Kawa Reserve, B.F.H. 28/9/83, MNZ M78877; Kaipara Flats Rd., B.F.H. 29/ 9/83, MNZ M78799. Kaipara Hills Rd., Q09/412248, B.F.H. 2/1/87, MNZ M97552. Omeru Reserve, B.F.H. & H. Taylor, 20/4/87, MNZ M99585. Kaipara Harbour, Puatahi Marae, 0.2 km N of Elbow Ck., Q09/389284, B.F.H. 2/1/87, MNZ M97593. Omaha, near Leigh, B.F.H.

4/10/76, MNZ M72426. Leigh, Frosts Rd. , B.F.H. 28/9/83, MNZ M82376. Little Barrier Is., A. Ballance, 8/81, NZ M77448. Great Barrier Island: Port Fizroy, A.E.B., AK; Northern Block, S08/269634, J.F.G. 24/3/90, AK; Motairehe, R.G. Ordish, 23/11/63, MNZ M25513 & 20/11/64, MNZ M28921; McLauglins Bush, T08 /320540, P. Anderson, 1988, MNZ M97293. Coromandel Peninsula: Port Charles - Colville Rd., N. Douglas, 8/1/69, AK; Port Jackson, S10/221195, J.F.G. 1/78, AK. 750 m SW of Colville Motel, T10/306044, D.J.R. 4/9/88, MNZ M101147. Waiwera, Puhoi Hill, A.W.B. Powell, 5/4/47, AK. North Shore: Orewa, C.R. Laws, AK; Kauri Gully, 6/6/26, AK. Tiritiri Matangi Island, P.M. 9/83, MNZ M82487. Waitakere Ranges: Titirangi Filter Station, R11/567726, J.F.G. 4/78, AK; Titirangi, B.F.H. 26/9/83, MNZ M78897; Huia, Q11/475696, J.F.G. 11/82, AK; Walkers Bush , B.F.H. 26/9/83, MNZ M75322; Muriwai, M.E. Fairburn, 27/10/26, AK. Hunua Ranges: Workman Track, S12/105548, J.F.G. 15/9/85, AK; Waharau Regional Park, S12/130600, J.F.G. 1/1/78, AK. Waiuku: W.H.W. AK; Waipipi Scenic Reserve, B.F.H. 3/1/77, MNZ M57668 & F.M.C. 11/ 2/81, MNZ M83490. Tairua, Charlottes Farm, P.M. 9/85, MNZ M76250. Glen Murray, R. Mannering, 2/6/72, MNZ M88515. Waikaretu, Mannering Farm, S. Mannering, 1972, MNZ M61584 & B.F.H. 17/9/77, MNZ M58255. Huntly, Waikawa Council Reserve, C.H. Broomfield, 1979, MNZ M72 251. Raglan, Te Toto Gorge, R14/666717, J.F.G. 3/84, AK.

Taguahelix francesci (Webster, 1904) Figs. 10-13

Synonymy: *Phrixgnathus francesci* Webster, 1904: 106 in part; Suter 1913: 745 in part. *Laoma (Phrixgnathus) francesci* Powell, 1979: 327 in part. *'Paralaoma'* n.sp.aff.33 Solem, Climo & Roscoe 1981: 479. Ballance 1982: 31. Punctid n.sp.7 Goulstone 1983: 42; 1990: 39. *Taguahelix* (n.subgen.1) *francesci* Climo 1992: 26, Fig.6a.

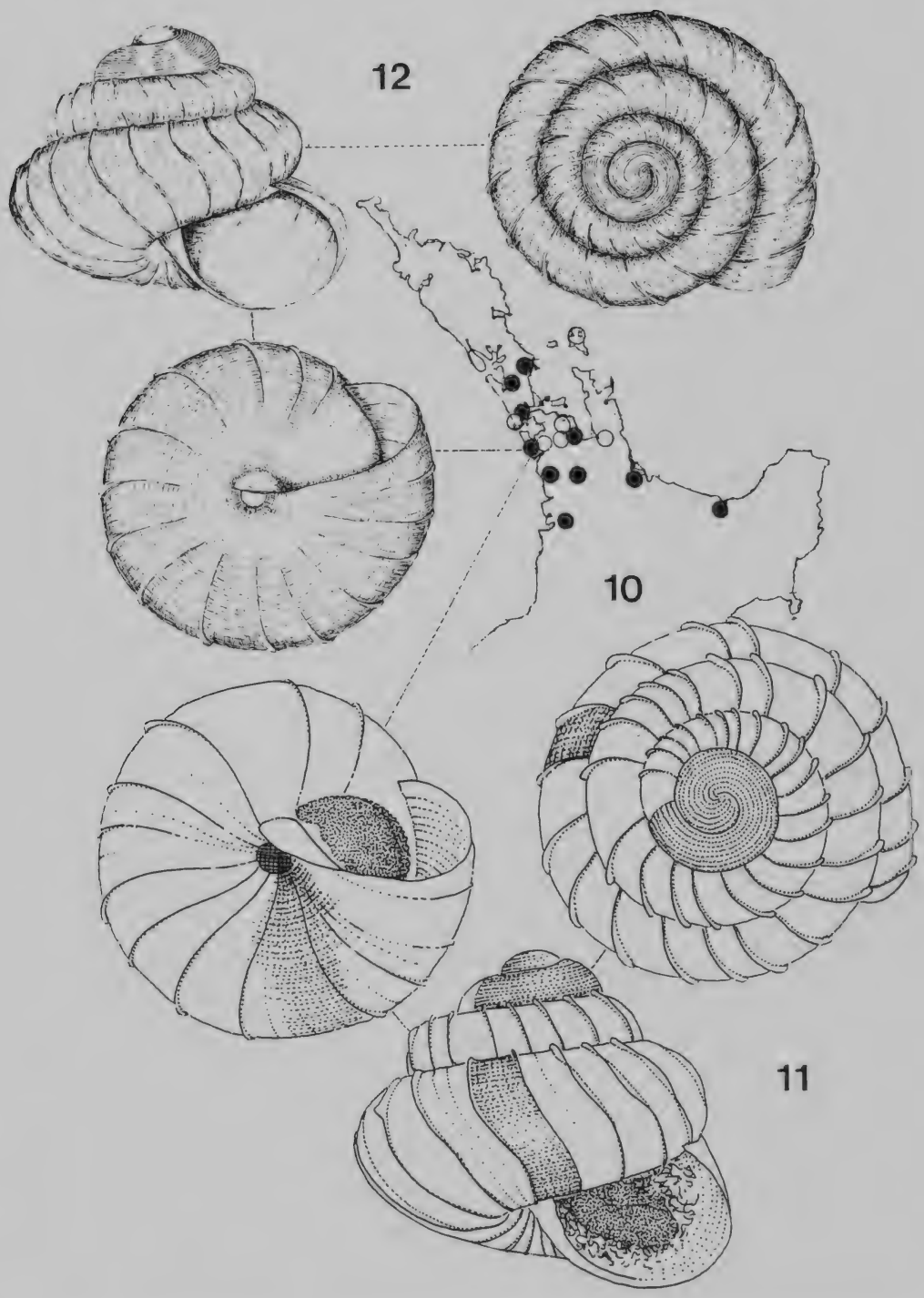
DESCRIPTION

Shell turbinate, 4.25 whorls, dark brown with the epidermis dull. Protoconch 1.75 whorls with about 15 strong spiral lirae. These lirae cover the whole shell somewhat muted on the following whorls but strong again on the base. Prominent radial periostracal processes, 5-6 per mm (c. 20 on the final whorl of an adult specimen), directed backwards, cover the post embryonic whorls and descend slightly onto the base. On a well preserved shell these can be quite tall and plate-like. Between these processes, in places, very fine hair-like ribs can be seen, but mostly these are rubbed off and irregular growth ridges are left. Periphery and base rounded, suture deep. Columella oblique, reflexed, slightly covering a narrow umbilicus.

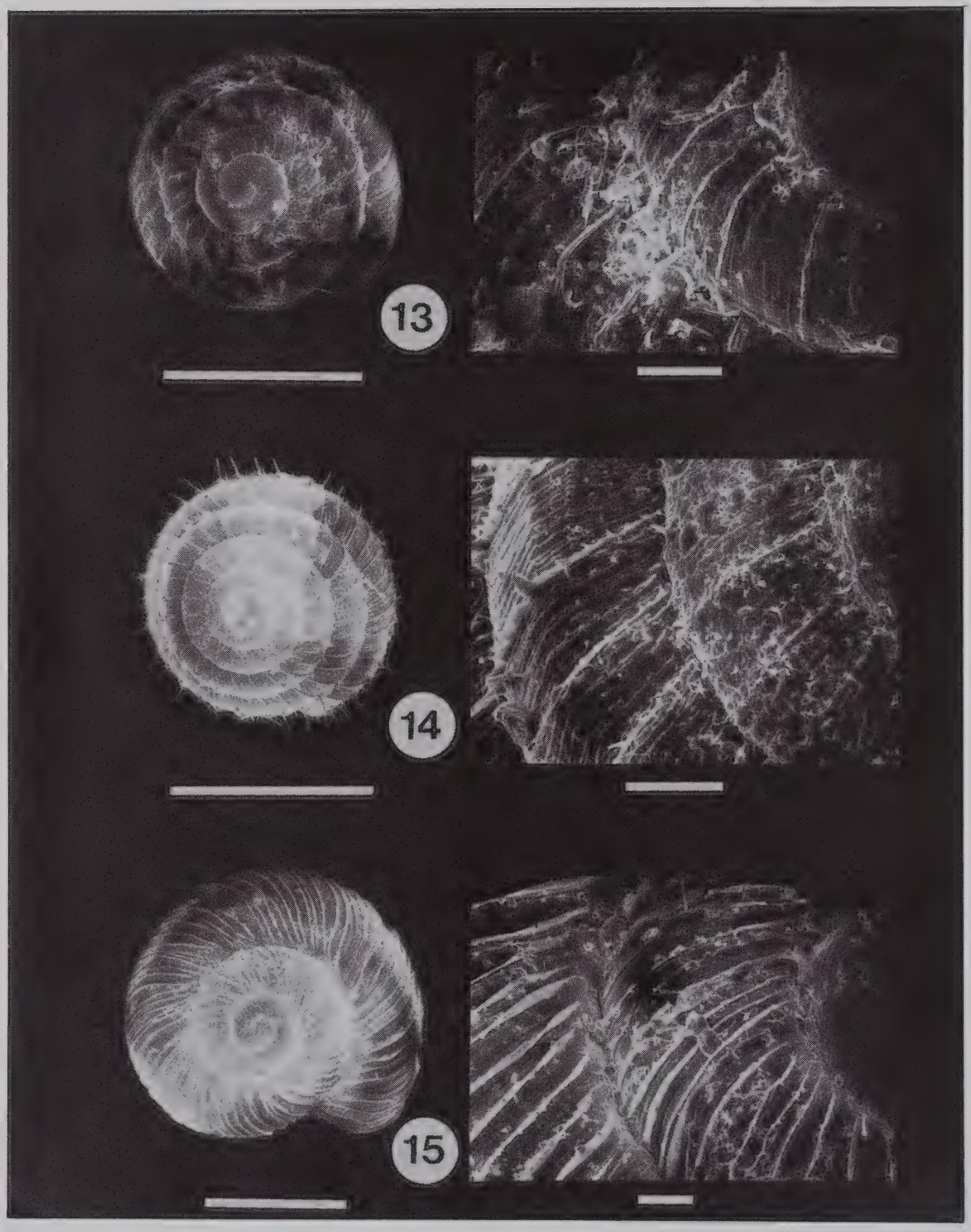
REMARKS

The types of *Taguahelix francesci* in the Auckland Museum collection examined by F.M. Climo in 1987 contained two species. There were six specimens of *Taguahelix francesci* Webster and 11 specimens of *Phrixgnathus douglasi* (AK 79437) though two of the latter were just pieces. Climo chose a lectotype and five paralectotypes from the ones which were closest to the original description.

Webster described the secondary ribbing of *T. francesci* as hairlike and some authors have taken this to mean that the shell had hairs, which is a feature of *Phrixgnathus douglasi.* However, the shells of *P. douglasi* in the type series had lost their hairs and this made the two species somewhat similar. For a few years before 1987 the hairy shell was recognised as *T.*



Figs. 10-12. *Taguahelix francesci*. 10. Geographic distribution. Solid dots are records from the Museum of New Zealand; open dots are records from the Auckland Museum. 11. Waiuku, 1.4 mm x 1.4 mm (lectotype AK 70385). 12. Waiuku, 1.4 mm x 1.4 mm (paralectotype AK 71556).



Figs. 13-15. Scanning electron photomicrographs. 13. *Taguahelix francesci*, Waiuku (paralectotype AK 71583). 14. *Phrixgnathus douglasi*, Little Barrier Island, A.E.B. (AK 79619). 15. *Phrixgnathus brunneus*, Motu River, A.E.B. (paratype AK 71584). Scale lines: left 1 mm, right 0.1 mm.

francesci but this was clearly wrong. Earlier collectors had not had this perception (see Discussion). Although only one Webster specimen in the Auckland Museum had one or two epidermal hairs (Fig. 21), it seems unlikely that Webster would have missed this feature if indeed this was the species he was describing.

There are two other small undescribed shells in the Auckland area (Punctid cf. n.sp.7 and Punctid n.sp.69 drawn in Goulstone 1990) which could be mistaken for *T. francesci* but the latter's brown colour when fresh should always separate it from these.

TYPE LOCALITY: Waiuku.

LECTOTYPE: Auckland Museum, AK 70385 (width 1.4 mm, height 1.4 mm).

PARALECTOTYPES (5): AK 71556 (two specimens), AK 71583, MNZ M115629 (two specimens). All these types are from Webster's type series .

HABITAT

A South Auckland survey (Goulstone 1990) showed that this species preferred more disturbed bush remnants or edges of bush and was not present in the deeper podocarp litter. It appears to be a ground dweller.

DISTRIBUTION

Great Barrier Island, Northern Block, S08/269634, J.F.G. 24/3/90, AK. Omaha Golf course, near Leigh, B.F.H. 4/10/76, MNZ M54273 . Warkworth, Beverley Price Track, Moirs Hill Walkway, B.F.H. 4/2/87, MNZ M97677; Kawa Reserve, Woodcocks, B.F.H. 28/9/83, MNZ M78873. Waitakere Ranges: Huia Dam, Q11/484695, J.F.G. 11/82, AK; Piha, Q11/427710, J.F.G. 3/82, AK; Fairy Falls, Q11/488758, J.F.G. 9/82 , AK; Titirangi, R11/581720, J.F.G. 8/82, AK; coast west of Blockhouse Bay, B.F.H. 17/8/86, MNZ M97695. Auckland, Howick, A.W.B. Powell, 4/6/27, AK. Papakura: Ponga Rd. Reserve, R12/885534, J.F.G. 13/6/87, AK; Ardmore Quarry Rd., R12/898594, J.F.G. 11/9/88, AK. Hunua Ranges: Waharau Regional Park, S12/125601, J.F.G. 10/83, AK; Cosseys Dam, S12/974568, J.F.G. 3/83, AK; Mangatawhiri, J.F.G. 1975 , MNZ M54235; Moumoukai Hill Rd. - Waharau Track, S11/623013, J.F.G. 2/11/86, AK. Bombay: Mt. William Reserve, S12/904409, J.F.G. 5/ 84, AK; Raventhorpe Scenic Reserve, R12/848466, J.F.G. 10/88, AK. Waiuku: Waipipi Scenic Reserve, broadleaf (*Griselinia littoralis*) & mamaku (*Cyathea medullaris*) litter, F.M.C. & D.J.R. 11,12/2/81, MNZ M78563. Webster Coll. ex A.C. O'Connor Coll., MNZ M88274. Waikato Heads Colebaker Reserve, P.M. 6/83, MNZ M87484. South Hapuakohe Range, Te Hoe, Mangatea Rd., *Astelia* litter, B.F.H. 7/10/78, MN Z M63508. Thames, Kaitarakihi Track, P.M. 1/84, MNZ M99307. Waitomo Village, 2.5 km E of shop, B.F.H. 13/11/77, MNZ M68481. Tauranga, Matakana Island, D.J.R. 16/4/79, MNZ M83479. Near Ohope, Kutarere, W15/739425, D.J.R. 10/7/78, MNZ M104563. Also recorded from Little Barrier, A. Ballance, 1982.

Phrixgnathus douglasi n. sp. Figs. 14, 16-22

Synonymy: *Phrixgnathus francesci* Webster, 1904: 106 in part; Suter 1913: 745 in part; Goulstone 1983: 36. Powell 1979: 327 in part. *'Paralaoma' francesci* Solem, Climo & Roscoe, 1981: 479.

DESCRIPTION

Shell small, turbinate of four whorls and sometimes five. Protoconch of 1.5 whorls faintly spirally striate, the striations continuing over the whole shell. The post embryonic whorls have thin radial periostracal processes rather distant, about 16-40 on the body whorl, which culminate in two rows of spiky hairs on each whorl. Some of these hairs are doubled and sometimes trebled (Fig. 18) in a staghorn effect, particularly on the last whorl. The space between this ribbing contains weak irregular growth lines rather overshadowed by the spirals. There are short, bristle like hairs on the base at each joint of a spiral and radial rib, sometimes the first two rows around the perimeter being closer together. The umbilicus is narrow and often partly covered by a reflexed columella.

REMARKS

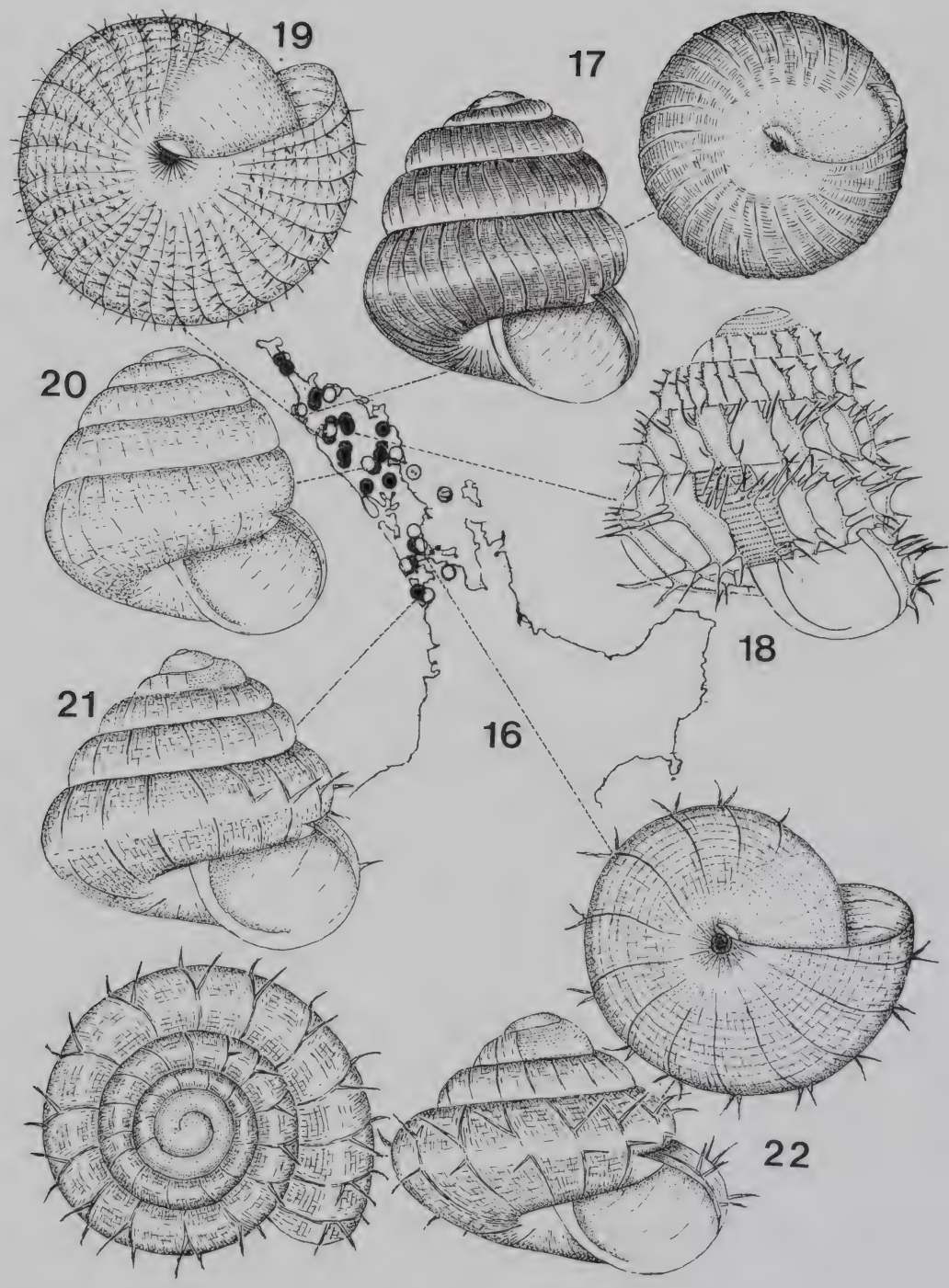
The shell of this snail changes with age. A full-grown adult will have five whorls and dimensions of 1.5 mm x 1.5 mm but a specimen of only four whorls will measure 1.3 mm x 1.0 mm. At the start of the Okura Walkway, North Shore, where they are reasonably common in damp, taraire-puriri (*Beilschmiedia tarairi, Vitex lucens*) forest they never seem to grow beyond four whorls. The same is true at Piha, Waitakere Ranges, in damp nikau (*Rhopalostylis sapida*) litter. Also in these two locations the rib count is low, only about 16 on the last whorl. Other rib counts on final whorls are: Little Barrier Island - 36 on a five-whorl specimen, 26 on a four-whorl specimen. Hen & Chickens Islands - 26 on a 3.5-whorl specimen. Mt. Huarua - 24 on a 4.5-whorl specimen, 22 on a four-whorl specimen. Kaingaroa - 36 on a five-whorl specimen, 40 on a five-whorl specimen.

One site at Okaihau had shells with elaborate epidermal processes not seen elsewhere (Fig. 18) and the base hairs of all the multi-ribbed shells seem to be more profuse and better developed (Fig. 19).

Samples from Mt. Huarua and north contain specimens that are globular (Fig. 20) and at the Herekino Gorge all the adult shells are taller and narrower (Fig. 17). Here also few had processes or hairs.

On Little Barrier Island shells had an interstitial sculpture of many sharp radial riblets, and indistinct spiral ridges (Fig. 14), which was at variance with all the mainland material. However, we have seen only specimens collected by A.E. Brookes many years ago.

TYPE LOCALITY: Okura River, North Shore, R10/631018. Remnant of puriri-taraire forest at start of Okura Walkway.



Figs. 16-22. *Phrixgnathus douglasi*. 16. Geographic distribution. Solid dots are records from the Museum of New Zealand; open dots are records from the Auckland Museum. 17. Herekino Gorge, 1.2 mm x 1.4 mm (AK 79614). 18. Forest Rd., Okaihau, 1.5 mm x 1.8 mm (MNZ M47325). 19. Waima Forest, 1.4 mm (AK 79615). 20. Tangihua Range, 1.1 mm x 1.2 mm (AK 79617). 21. Waiuku, 1.5 mm x 1.5 mm (AK 79618). 22. Okura River, 1.3 mm x 1.0 mm (holotype AK 71560).

HOLOTYPE: Auckland Museum, AK 71560 (width 1.3 mm, height 1.0 mm). Okura River, J.F. Goulstone, 4/2/93.

PARATYPES (12): AK 71561 (6 specimens), Okura River, J.F.G. 4/2/93. MNZ M115627 (6 specimens), Okura River, J.F.G. 15/9/91.

HABITAT

Litter, especially fairly damp litter. Undisturbed bush, though B. Hazelwood (pers. comm.) reports the site at Okaihau mentioned in the Remarks was disturbed.

DISTRIBUTION

Just N of Te Kao, D.J.R. 2/1/76, MNZ M88279. Mount Camel, N03/258088, R. Parrish & K. Walker, 6/3/88, MNZ M96551. North Mangamuka Gorge, D.J.R. 30/12/78, MNZ M61908. Waitetoki, P.M. 12/83, MNZ M101608. Mangatete Reserve, P.M. 12/83, MNZ M82450. Mt. Maungamuka, R.R. Forster, 7/1/67, MNZ M88275. Mangonui, Oruru Valley, R. Wallace, 1986, MNZ M87637. Herekino Gorge, L. Fitzgerald 1/71, AK. Kaingaroa, A.E.B., AK. Okaihau, Forest Rd., B.F.H. 4/1/76, MNZ M47325. Hokianga, Opononi, W. LaRoche, 1928, AK. Utakura, Austens Block, P05/712474, P.M. 11/87, MNZ M97934. Waima State Forest: Waiotemarama, P.M. 11/86, MNZ M98262 & 11/84, MNZ M97717; Waiotemarama, O06/505298, J.F.G. 5/90, AK. Waipoua Forest: O06/623165, J.F.G. 4/89, AK; M.L. Tapply, 12/69, MNZ M88785; Waimatenui, N. Gardner, 3/68, MNZ M37695; rest area, B.F.H. 6/10/76, MNZ M55829. Kaihu Scenic Reserve, P.M. 11/86, MNZ M98214. Montgomery South Reserve, P08/4 73761, R. Parrish, 31/5/89, MNZ M115624. Bland Bay, P.M. 10/78, MNZ M82981. Horahora Estuary, Pataua, P.M. 9/84, MNZ M82464 & 9/78, MNZ M58154. Helena Bay, V. Kessner, 27/10/83, AK. Parakao, Drinnan Rd., P.M. 2/80, MNZ M63270. Whangarei, Coronation Reserve, A.W.B., Powell, 16/12/68, AK. Whangarei Heads, Mt. Manaia, B.F.H. 26/10/91, AK & 4/3/85, MNZ M76813. Glenbervie State Forest, Marua Rd., P.M. 11/86, MNZ M98282. Hen & Chickens Islands, Taranga Is., A.E.B., AK. Tangihua Range, Mt. Huarua, M.E. Fairburn, AK. 16.3 km S of Dargaville, D.J.R. 22/11/75, MNZ M88277. Waipu Gorge Scenic Reserve, Waterfall Track, Q08/356700, B.F.H. 4/3/85, MNZ 75551. Little Barrier Is., A.E.B., AK. Waiwera, A.E.B., AK. Okura Walkway, P.M. 6/87, MNZ M99368. Waitakere Ranges: Piha, Q11/427310, J.F.G. 3/82, AK. & 1981, MNZ M70828; Huia, Q11/498698, J.F.G. 11/11/90, AK. Hunua Ranges, Moumoukai Hill Rd. - Waharau Track, S11/623013, J.F.G. 2/11/86, AK. Waiuku, W.H.W. AK. & W.H.W. ex A.C. O'Connor collection, MNZ M88273. Manukau Peninsula, Harveys Bush, F.M.C. 15/2/81, MNZ M82312.

ETYMOLOGY

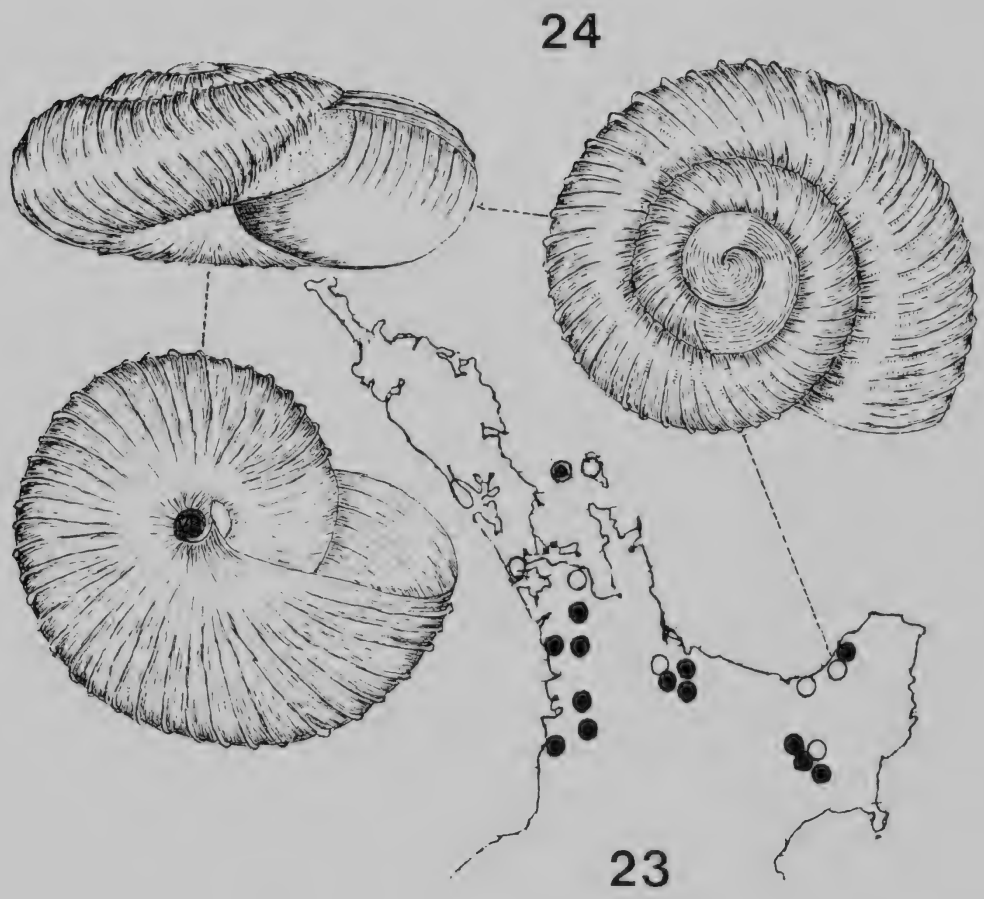
We have named this species after the late Norman Douglas, from Waiuku, who sometimes collected small land snails.

***Phrixgnathus brunneus* n. sp. Figs. 15, 23-24**

Synonymy: '*Paralaoma*' n.sp.40 Solem, Climo & Roscoe, 1981: 479; '*Phrixgnathus*' n.sp.40 Ballance 1982: 31. Punctid n.sp.40 Goulstone 1983: 45, 1990: 41.

DESCRIPTION

Shell small, flat, spire only slightly raised. Protoconch 1.25 whorls, faintly concentrically striate. Shell 3.25 whorls quickly accelerating. Post-embryonic whorls with close, irregular, sharp radial periostracal processes sweeping backwards and proceeding half way over the base before reducing to little more than ridges near the umbilicus. Between these processes there are a few fine radials crossed by stronger concentric striae though somewhat fainter on the base. The umbilicus is quite narrow but open, not much affected by the columella which is oblique, thin and hardly reflexed. Colour dark brown when fresh.



Figs. 23-24. *Phrixgnathus brunneus*. 23. Geographic distribution. Solid dots are records from the Museum of New Zealand; open dots are records from the Auckland Museum. 24. Motu River, 2.5 mm x 1.3 mm (holotype AK 71562).

REMARKS

The 80 specimens collected by A.E. Brookes c. 1930 at the Motu River are lighter brown in the centre than others we have examined and golden at the perimeter, but this could be due to the age of the collection. This snail looks like a Flammulinid but it has affinities with both a Lord Howe Island Punctid and two sub-antarctic islands species and is better left in *Phrixgnathus* until its true position is evaluated.

TYPE LOCALITY: Motu River, Bay of Plenty. The Museum of New Zealand has specimens collected by Brookes labelled Motu River Bridge, Opotiki-Cape Runaway Highway.

HOLOTYPE: Auckland Museum, AK 71562 (width 2.5 mm, height 1.3 mm), Motu River, A.E. Brookes.

PARATYPES: AK 71563 (70 specimens) Motu River, A.E. Brookes. MNZ M115630 (10 specimens) Motu River, A.E. Brookes.

HABITAT

Under bark on fallen rotting logs. At Clevedon, South Auckland, it occurs in modified bush.

DISTRIBUTION

Great Barrier Island, Mt. Hirakimata, S08/276543, J.F.G. 23/3/90, AK. Little Barrier Island, A.E.B., AK. Titirangi: A.E.B., AK; Kauri Knoll, R11/517722, Mrs. D. Hole, 17/5/71, AK. Clevedon, Duders Bush, S11/943738, J.F.G. 11/3/90, AK. Hunua Ranges, Mangatawhiri, J.F.G. 1975, NMZ M51741 & 3/10/67, MNZ M37553. Waikaretu, Mannering Farm, G. Mannering, 1972 MNZ M47187. Ngaruawahia, Hakarimata Reserve, C. Broomfield, 7/77, MNZ M57482, M57904 & B.F.H. 30/1/78, MNZ M72388. Wairere Range, Matamata, A.E. B., AK. Upper Kaimai, A.E.B., AK. Kaimai summit, T15/687667, D.J.R. 15/4/78, MNZ M104610. Ngutunui, Walter Scott Reserve, P.M. 1977, MNZ M57540. Moeatoa State Forest, Moeatoa Track, P.M. 4/91, MNZ M70270. Waitomo: intersection S end of Mahoe Rd., B.F.H. 4/1/77, MNZ M55188; cave entrance, F.M.C. 18/2/81, MNZ M77584. Mamaku Plateau, Pukerimu Reserve, P.M. 4/78, MNZ M98288. Mamaku, W18/644694 D.J.R. 31/12/72, MNZ M48011 . Summit of Mt. Ngongotaha, C. Broomfield, 12/77, MNZ M69094 & B.F.H. 2/1/ 77, MNZ M69795. Opotiki, A.E.B. 2/7/28 AK. Motu River bridge, A.E.B. 1928- 31, MNZ M83504. Te Kaha, P.M. 7/86, MNZ M87643. Urewera National Park: Whanganui Inlet, Waikaremoana, W18/613680, J. F.G. 5/76, AK & 1975, MNZ M51742; Maungapohatu, P.M. 2/82, MNZ M76304; Manuoha 2000', W18/644694, L. Daniel, 4/89, MNZ M93061. North Volcanic Plateau, Leyland O'Brien Tramway, P.M. 6/87 MNZ M99335.

DISCUSSION

The Rev. W.H. Webster, an early collector of New Zealand mollusca (c. 1900-1910), was a contemporary of H. Suter. He came to New Zealand later in his life and took up an appointment at a small church in Waimauku (now Mauku) near Waiuku. His landsnail collection, comprising 124 lots now in the Auckland Museum, was built up by his sharp-eyed

son Francis. Waiuku, on the Manukau lowlands is a closely settled farming area today and most of the bush in which the snails were collected is gone. The Waipipi Scenic Reserve, several kilometres north of the township, is the best remaining bush close to Waiuku and samplings in recent years have found both *T. francesci* (Webster, 1904) and *T. elaiodes* (Webster, 1904) though they are scarce.

A.E. Brookes about 1930 put aside prospective types of *P. douglasi* which he intended dividing into three species, "Aeschrodomus chrysomorphus" from Little Barrier Is.; "Aeschrodomus pagodaela" from Kaingaroa, Northland and "Aeschrodomus fairburni" from the Tangihua Range. From the more extensive material which is now available this division of *P. douglasi* into three species seems feasible, but in this paper we have preferred to take a conservative view and treat it as one. Also, it is not a Charopid species but has obvious affinities with what was known prior to 1979 as *Phrixgnathus regularis* (Pfeiffer, 1855). (Climo 1979 explains the status of *P. regularis* now). This is a widespread snail further south, which does not overlap the range of *P. douglasi*.

For *P. brunneus* there were tubes labelled "Holotype" and "Paratypes" in the Auckland Museum collection with the labels "Flammulina brunneum or Flammulina innotatum". A.E. Brookes actively collected snails from the 1920s to the 1950s over most of New Zealand and N. Gardner believes that he worked as a builder on the construction of the Motu River bridge. The Auckland Museum has 600-700 lots which Brookes presented and he was a president of the Auckland Museum Conchology Section Shell Club for some years. The club owns the "Brookes Collection", a display series containing many snails arranged for easy viewing. The Museum of New Zealand also has many of his specimens. His obituary appears in the Conchology Section Bulletin No. 11, 1955.

Acknowledgements. We thank Dr Bruce Hayward for much encouragement and tidying of the text. Also Bruce Hazelwood for valuable advice and loan of maps, Hugh Grenfell for help with the electron microscope and Norman Gardner for checking the manuscript and giving us information on A.E. Brookes. Kevin Burch of Whangarei recounted some fascinating information on his great grandfather Rev. W.H. Webster.

REFERENCES

BALLANCE, A.
1982 Land snails of Little Barrier Island. *Tane* 28:29-35.

CLIMO, F.M.
1979 The systematic status of some landsnails mistakenly assigned to the New Zealand fauna. *N.Z. Journal of Zoology* 6:407-410.
1992 Some Tasman Punctid land snail margins and centres - a collage. *Cookia* 6(4):17-36.

GOULSTONE, J.F.
1983 Waitakere landsnails. *Poirieria* 13(1):1-69.
1990 Landsnails from South Auckland. *Poirieria* 16(2):2-44.
1992 Notes of interest. *Poirieria* 16(4):21.

GOULSTONE J.F., P. MAYHILL and R. PARRISH
1993 An illustrated guide to the land mollusca of the Te Paki Ecological Region, Northland, New Zealand. *Tane* 34:1-32.

POWELL, A.W.B.
1955 Mollusca of the southern islands of New Zealand. *D.S.I.R. Cape Expedition Series* 15:125.
1979 *New Zealand Mollusca*. Collins, Auckland.

SOLEM, A., F.M. CLIMO and D.J. ROSCOE
1981 Sympatric species diversity of New Zealand land snails. *N.Z. Journal of Zoology* 8:453-485.

SUTER, H.
1913 *Manual of the New Zealand Mollusca.* Government Printer, Wellington.

WEBSTER, W.H.
1904 New Mollusca from New Zealand. *Proceedings of the Malacological Society* 6(2):106.

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[SHORT NOTE]

MENIMUS CROSBYI, A NEW NAME FOR *M. CLARKEI* WATT, 1992 (COLEOPTERA: TENEBRIONIDAE)

J.C. WATT

MANAAKI WHENUA LANDCARE RESEARCH NEW ZEALAND

Recently it came to my attention that the New Zealand species *Menimus clarkei* Watt, 1992 is a junior homonym of *M. clarkei* Kaszab, 1985 from Fiji. The new name *Menimus crosbyi* is proposed here for *M. clarkei* Watt.

I would like to thank Dr T.K. Crosby for first bringing this homonymy to my notice, and J.W. Early for assistance with preparing this note.

REFERENCES

KASZAB, Z.
1985 Beiträge zur Kenntnis der pazifischen Tenebrioniden (Coleoptera). *Folia Entomologica Hungarica* 46: 23-63.

WATT, J.C.
1992 Tenebrionidae (Insecta: Coleoptera): catalogue of types and keys to taxa. *Fauna of New Zealand* 26: 1-69.

J.C. WATT, Manaaki Whenua Landcare Research New Zealand, Private Bag 92170, Auckland.

PRIMARY TYPES OF TERRESTRIAL AND FRESHWATER PROTISTA, ANNELIDA AND ARTHROPODA IN THE AUCKLAND INSTITUTE AND MUSEUM: AN ANNOTATED LIST

J.W. EARLY AND R.F. GILBERT
AUCKLAND INSTITUTE AND MUSEUM

Abstract. Primary types (holotypes, syntypes, lectotypes and neotypes) of 265 species of terrestrial and freshwater Protista, Annelida and Arthropoda curated by the Entomology Department of the Auckland Institute and Museum, New Zealand, are listed. Collection information, derived from a combination of specimen labels and published data, and a full bibliographic reference are given for each.

The Entomology Department of the Auckland Institute and Museum is responsible for collections of terrestrial and freshwater aquatic invertebrates (other than Mollusca). The collection currently holds about 345 000 specimens (mostly insects), pinned, in alcohol and on microscope slides. Among them are primary types of 265 species. Lists of primary types held in the collection were published by Powell (1941, 1949) but since that time many more have been added and some missing ones found while others listed by him cannot be located at present.

A grant from the New Zealand Lottery Grants Board enabled us to isolate primary types from the main collection and prepare a 35 mm colour slide photographic catalogue of these specimens and their labels. The purpose of the photographic catalogue is to document the physical condition, configuration, method of mounting, number of labels and handwriting, all important features of primary types that cannot easily or adequately be recorded in a list such as this paper. The photographic catalogue itself will not be published but copies of individual slides are available for study. It will be updated as new primary types are accessioned. We take this opportunity to publish a current list of primary types in the Auckland Institute and Museum, a responsibility urged on all institutions holding such specimens by the International Commission on Zoological Nomenclature (1985, Recommendation 72G).

Type terminology can be confusing, and people have differed in their interpretation of what constitutes a primary type. We follow the definitions of the ICZN (1985) which admit only holotypes, syntypes, lectotypes and neotypes. Syntypes from which a lectotype has subsequently been selected are paralectotypes, but we include them here for the single case that this situation arises since they are still the original equally-ranked members of the author's syntype series. The term 'cotype' was used by many early authors but in the two very different senses of syntype and paratype as currently understood. Only the former are included in this list under the heading 'syntype' regardless of the name 'cotype' appearing on the author's labels. Allotypes are excluded since they merely represent a designated paratype of the opposite sex to the holotype.

MISSING TYPES

The types of Coleoptera from the Kermadec Is described by Broun (1910a) are published as being in the Auckland Museum (AMNZ). While most have been located, Powell (1941) noted that two were missing (*Coxelus xanthonyx, Rhyncogonus planidorsis*); in addition, though not listed by him, the type of *Microtribus sculpturatus* from the same publication cannot be found. The types, including the type of *Coxelus punctatus*, have since been located in the Natural History Museum, London (BMNH). There is no evidence that they were ever sent there on loan. Rather, it seems that they were never deposited in the AMNZ as they should have been but remained in Broun's collection, eventually going with it to London as part of Broun's bequest. Under an agreement between the two museums in 1969, the types of *C. punctatus* and *R. planidorsis* were transferred from the BMNH to the AMNZ in exchange for AMNZ's specimen of *C. punctatus* which had hitherto been presumed to be the type; the BMNH retained the type of *C. xanthonyx*. One of the two syntypes of *Microtribus sculpturatus* Broun was also located in the BMNH where it remains; the other has not been found.

As part of this curatorial exercise, several missing or previously unrecognised primary types of New Zealand Lepidoptera were 'discovered' in the Clarke collection. They are: *Carposina sanctimonea* Clarke, *Leucania hartii* Howes, *Melanchra dives* Philpott, *Morrisonia longstaffii* Howes and *Morrisonia pascoei* Howes. Types that cannot be located are: *Mimopeus parvus* Watt, *Epithectis transversella* Hudson, and *Mallobathra memotuina* Clarke.

SOURCES OF PRIMARY TYPE SPECIMENS

The origin of the type specimens and their distribution among the major groups of invertebrates tells something of the history of the Auckland Museum's collections in entomology and also partly reflects the interests of former staff and associates. Three significant sources of type material can be recognised.

1. The C.E. Clarke Collection:
Clarke was an amateur entomologist who collected extensively in Otago, Southland, parts of Fiordland and around Auckland, and also in the Pacific islands and Australia. He donated part of his collection to the Auckland Museum shortly after the present building was opened in 1929. After his death, the Museum jointly purchased and divided the remainder with the BMNH. Clarke's collection accounts for almost half of the present holdings of primary types: 86 Lepidoptera species described by him, Hudson, Howes and Philpott, and an additional 21 species from various insect orders subsequently described by other entomologists.

2. Expeditions to offshore islands:
The 1940s to 1960s saw many large-scale expeditions to various offshore islands, particularly the Three Kings in 1946 (E.G. Turbott) and 1952-53 (J.S. Edwards), and the subantarctic islands (E.G. Turbott). Turbott did not describe any new species of invertebrates himself, but 43 species have been described by others from his material in the Auckland Museum collection.

3. Collecting and research activities of K.A.J. Wise:
K.A.J. Wise was the Museum's first Curator of Entomology. His systematic programme of invertebrate extraction from soil and leaf litter procured specimens of many Araneae and Pseudoscorpionida that became holotypes. Specialist collecting in the intertidal zone of rocky shores produced new species of Acari and Coleoptera, and in addition he described several new species of Trichoptera from the C.E. Clarke Collection. His efforts have resulted in 38 primary types.

ARRANGEMENT OF THE LIST

In the following list, taxonomic groupings of phyla and classes are presented phylogenetically but beyond that subdivisions are alphabetical. Since a species is recognised by its binomen and not just the specific epithet, species are listed alphabetically by the genus in which they were originally placed. No attempt has been made to provide current nomenclature for each species, nor are families given because many of the species have been placed in several families at different times depending on current opinion on higher classification. Entries are arranged much in the format adopted by Palma, Lovis & Tither (1989) as follows:

> ***Species binomen*** Author, date: page number on which description commences.
> TYPE category, sex if known, means of preservation.
> Label data in the format: Locality (from general to specific), date of collection, collector's name. Habitat data.
> *Note:* Explanatory note if required.

Entries prefixed by an asterisk (*) denote specimens which are recorded as belonging to the Auckland Institute and Museum but which cannot be located at present or are held elsewhere.

Locality and habitat data are taken from a combination of labels and published information and are edited into a more-or-less consistent format. Discrepancies between the two sources are common but it is usually clear as to which is the more reliable. It is not the purpose of this paper to resolve all these problems where they arise; rather, subsequent specialists and revisers should judge for themselves. We have not attempted to give data exactly as on labels since that sort of information is available from the photographic catalogue.

Abbreviations for geographical and locality information follow Walker & Crosby (1988). Acronyms for insect collections are as follows:

AMNZ	Auckland Institute and Museum.
NMNZ	Museum of New Zealand (formerly National Museum of New Zealand), Wellington.
BMNH	The Natural History Museum, London (formerly the British Museum (Natural History)).
NZAC	New Zealand Arthropod Collection, Mt Albert Research Centre, Auckland.

Phylum **SARCOMASTIGOPHORA**

Spirotrichosoma magna Helson, 1935: 251
HOLOTYPE, slide
South Island, Kaituna, 1933. From *Stolotermes ruficeps*.

Phylum **ANNELIDA**
Class **OLIGOCHAETA**

Megascolex animae Lee, 1959: 281
HOLOTYPE, wet
Northland, Unuwhao, near Spirits Bay, Feb 1946, A.W.B. Powell.
Note: Dissected spermatheca in enclosed smaller vial.

Megascolides tasmani Lee, 1959: 313
HOLOTYPE, wet
Three Kings Is, Great I, Tasman Stm, 31 Dec 1952, J.S. Edwards. Wet greywacke gravel.
Note: Dissected spermatheca in enclosed smaller vial.

Notoscolex equestris Benham, 1942: 220
SYNTYPES (2), wet
Poor Knights Is, Tawhiti Rahi I, 26 Nov 1940, G.A. Buddle, R.A. Wilson, E.G. Turbott, Auckland Museum 138/41.
Note: There are two specimens in the jar. No holotype was designated but the "larger of the two" could be construed as the holotype by implication from the text.

Rhododrilus insularis Lee, 1959: 159
HOLOTYPE, wet
Three Kings Is, South West I, Jan 1952, M.E. Johnston, 788. Ex leaf mould.
Note: Spermatheca in enclosed smaller vial.

Rhododrilus ravus Lee, 1959: 171
HOLOTYPE, wet
Three Kings Is, Great I, Crater Head, 7 Jan 1953, J.S. Edwards. *Melicytus* litter grove.
Note: Spermatheca in enclosed smaller vial.

Rhododrilus tetratheca Lee, 1959: 179
HOLOTYPE, wet
Three Kings Is, Great I, Saddle above Castaway Valley, 7 Jan 1953, J.S. Edwards. Subsoil.
Note: Spermatheca and penial chaeta in smaller enclosed vial.

Phylum **ARTHROPODA**
Class **CHILOPODA**

Ballophilus hounselli Archey, 1936: 45

HOLOTYPE, wet & slide G20.1
S of Waikato Heads, Waikawau, 24 Apr 1932, G. Archey.
Note: No type specimen mentioned in publication, nor is locality of type included in published localities but specimen is labelled TYPE in Archey's handwriting. Slide, in poor condition, appears to contain 3 parts: head capsule and antennae, maxillae and palps, and poison claw. Body of type pale and soft.

Class **ARACHNIDA**
Order **ACARI**

Dendrolaelaps (Pontiolaelaps) crenatus Luxton, 1984: 84
HOLOTYPE ♀, slide
N Auckland, Leigh, Omaha Cove, 5 Dec 1968, K.A.J. Wise. Intertidal zone, sheltered rock platform.

Dendrolaelaps (Pontiolaelaps) terebratus Luxton, 1984: 92
HOLOTYPE ♀, slide
N Auckland, Leigh, exposed rock platform opposite Goat I, 5 Dec 1968, K.A.J. Wise. From *Elminius* sp on rock.

Geckobia haplodactyli Womersley, 1941: 325
HOLOTYPE ♀, slide
Auckland, 1941. On *Hoplodactylus duvaucellii.*
Note: The specific epithet and host genus are consistently misspelled *haplodactyli* and *Haplodactylus* in the publication. Although correctly spelled *hoplodactyli* and *Hoplodactylus* on the specimen label, the name as published must stand since there is no clear internal evidence within Womersley's paper of inadvertent error (ICZN, 1985, Article 32c).

Geckobia nautilina Womersley, 1941: 328
HOLOTYPE ♀, slide
N.Z.

Leioseius australis Luxton, 1984: 96
HOLOTYPE ♀, slide
N Auckland, Leigh, exposed rock platform opposite Goat I, 5 Dec 1968, K.A.J. Wise. From barnacles (*Elminius*) on rock.

Pontiolaelaps salinus Luxton, 1989: 413
HOLOTYPE ♀, slide
Otago, Portobello, Marine Biology Laboratory, Feb 1968, M. Luxton. From *Bostrychia.*

Order **ARANEAE**

Aparua hapua Forster, 1968: 135

HOLOTYPE ♀, wet
Little Barrier I, Summit Track, 22 Nov 1947, E.G. Turbott. In possession of a black wasp.

Aparua houhora Forster, 1968: 135
HOLOTYPE ♀, wet
North I, Houhora

Aparua regia Forster, 1968: 136
HOLOTYPE ♀, wet
Three Kings Is, Great I, camp and depot area, 18 Mar-14 May 1946, E.G. Turbott.

Aparua taranga Forster, 1968: 131
HOLOTYPE ♀, wet
Hen I, 21 May 1949, E.G. Turbott. In tube nest.

Armigera turbotti Marples, 1956: 336
SYNTYPE ♂, wet
Three Kings Is, Great I. Under stones Quadrat 1.
Note: Marples did not designate a holotype so the 2 ♂♂ mentioned are regarded as syntypes. This specimen appears to be the one on which the description was based. The other specimen, which was "prepared by boiling in potash" cannot be located.

Cambridgea turbotti Forster & Wilton, 1973: 150
HOLOTYPE ♀, wet
Three Kings Is, Great I, 14 May 1946, E.G. Turbott. Under stone, bare ground under *Limra* in Quadrat 1.
Note: Epigynum and internal genitalia in enclosed microvial.

Chiracanthium insulare Marples, 1956: 332
HOLOTYPE ♂, wet
Three Kings Is, Great I.
Note: Specimen has been relabelled since Forster & Blest (1979) erected and transferred the species to the genus *Kaitawa.* No original labels remain.

Drapetisca australis Forster, 1955: 193
HOLOTYPE ♀, wet
Antipodes Is, top of slopes above Ringdove Bay, 10 Nov 1950, E.G. Turbott. Ex mould under *Poa literosa* with *Polystichum vestitum.*

Gasparia coriacea Forster, 1970: 98
HOLOTYPE ♂, wet
White I, Ohaura, 6 Dec 1966, K.A.J. Wise. Auckland Museum plant/soil sample 121, *Histiopteris* leaf litter.
Note: Abdomen in enclosed microvial.

Gasparia mangamuka Forster, 1970: 87
HOLOTYPE ♀, wet

Hokianga, Mangamuka Gorge, 19 Nov 1966, K.A.J. Wise. Auckland Museum plant/soil sample 104, ex leaf mould.

Gasparia nebulosa Marples, 1956: 85
HOLOTYPE ♀, wet
Thee Kings Is, Great I, Quadrat 1.

Hapona paihia Forster, 1970: 117
HOLOTYPE ♀, wet
Bay of Islands, 3 miles S of Paihia, 8 Dec 1966, K.A.J. Wise. Auckland Museum plant/soil sample 172, ex leaf litter by swamp.
Note: Date on label and as published (8 Dec) disagree with Auckland Museum plant/soil sample register (18 Dec).

Hexathele pukea Forster, 1968: 148
HOLOTYPE ♀, wet
King Country, Pukemako, 1962, Howard Hill Collection.

Huka alba Forster & Wilton, 1973: 83
HOLOTYPE ♀, wet
East side of Ruapehu, Waihohonu Stm, 945 m, 17 Jan 1967, K.A.J. Wise. Auckland Museum plant/soil sample 191, moss on ground in beech forest.
Note: Allotype ♂ in same tube.

Lithyphantes regius Marples, 1956: 337
HOLOTYPE ♀, wet
Three Kings Is, Great I, 12 May 1946, E.G. Turbott.
Note: Identified as *Steatoda lepida* (O.P. Camb.) by S.B. Hann, 25 Nov 1991. Formal synonymy not published.

Migas borealis Wilton, 1968: 82
HOLOTYPE ♀, wet
Three Kings Is, Great I, 5 Jan 1953, J.S. Edwards.
Note: Right legs and pedipalps in enclosed microvial.

Migas insularis Wilton, 1968: 96
HOLOTYPE ♀, wet
Little Barrier I, Summit Tom Thumb Track, 7 Oct 1945, E.G. Turbott.
Note: Right legs and pedipalp in enclosed microvial.

Muritaia longispinata Forster & Wilton, 1973: 267
HOLOTYPE ♀, wet
Whakatane Co, Forest E of L Rotoma, 5 Oct 1966, K.A.J. Wise. Auckland Museum plant/soil sample 66, leaf litter.
Note: The vial of types contains 2♀♀. The holotype is the undissected specimen (R.R. Forster, *in litt,* 21.vii.1993).

Novalaetesia anceps Millidge, 1988: 42

HOLOTYPE ♀, wet

Mangonui Co, North Cape area, Unuwhao, 610 m, 22 Feb 1967, K.A.J. Wise. Auckland Museum plant/soil sample 217, forest remnant, leaf litter in pits on ridge.

Note: ♀ internal genitalia in enclosed microvial.

Oramiella wisei Forster & Wilton, 1973: 84

HOLOTYPE ♂, wet

Northland, N of Maungaturoto, 9 Jul 1967, K.A.J. Wise. Auckland Museum plant/soil sample 294, ex moss on tree.

Note: Right pedipalp in enclosed microvial.

Paramamoea aquilonalis Forster & Wilton, 1973: 219

HOLOTYPE ♀, wet

North I, Bay of Islands Co, forest 3 miles S of Paihia, 18 Dec 1966, K.A.J. Wise. Auckland Museum plant/soil sample 172, leaf litter by swamp.

Note: Right legs and pedipalp, epigynum and genitalia in 2 enclosed microvials.

Paramamoea pandora Forster & Wilton, 1973: 221

HOLOTYPE ♀, wet

Mangonui Co, North Cape area, 3 miles SE of Unuwhao, 183 m, 24 Feb 1967, K.A.J. Wise. Auckland Museum plant/soil sample 236, leaf litter.

Note: The vial of types contains several specimens. The holotype is the undissected ♀ (R.R. Forster, *in litt,* 21.vii.1993) in the microvial also containing a dissected ♀ and a subadult ♂ and ♀. The allotype is in a separate enclosed microvial.

Paramamoea parva Forster & Wilton, 1973: 220

HOLOTYPE ♀, wet

Waipoua, Jan 1952, W.R McGregor. Ex leaf mould.

Note: This specimen has been relabelled and originals are absent. There is internal inconsistency between labels and published information seems to be more accurate. Two other labels read: "*Paramamoea waipoua* For, Hol ♀, Waipotia [sic]..." and "*Paramamoea parva* F,W., Allotype ♀", casting doubt as to which species this is and its type status. The specimen is ♀ so cannot be the holotype of *P. waipoua* which is ♂ and is in the Otago Museum (see Forster & Wilton 1973:221-222). Also note that specimen is a holotype ♀, not an allotype ♀.

Subantarctia turbotti Forster, 1955: 170

HOLOTYPE ♀, wet

Auckland Is, Carnley Hbr, E shore N Arm, 28 Oct 1944, E.G. Turbott. Under sticks.

Theridion longicrure Marples, 1956: 339

HOLOTYPE ♂, wet

Three Kings Is, Great I.

Order **OPILIONES**

Achihasta salebrosa Forster, 1948: 315
HOLOTYPE , wet
Three Kings Is, Great I, 29 Apr 1946, E.G. Turbott. Under stone.

Triregia monstrosa Forster, 1948: 317
HOLOTYPE , wet
Three Kings Is, Great I, ridge above depot, 6 May 1946, E.G. Turbott. Under stones.

Order **PSEUDOSCORPIONIDA**

Apatochernes cruciatus Beier, 1976: 230
HOLOTYPE ♂, wet
E coast Coromandel, Green I, West end, 26 Apr 1967, J.A.F. Jenkins. Auckland Museum plant/soil sample 275, leaf litter and soil.
Note: Allotype in same tube.

Apatochernes solitarius Beier, 1976: 231
HOLOTYPE ♀, wet
Coromandel Pen, E coast, S side Te Anaputa Pt, 10 Dec 1966, K.A.J. Wise. Auckland Museum plant/soil sample 150, nikau leaf litter.

Apatochernes turbotti Beier, 1969: 417
HOLOTYPE ♂, wet
Three Kings Is, South West I, 13 Jan 1951, E.G. Turbott. Auckland Museum plant/soil sample 2, under small groves of low karaka and puka in scrub half-way down NE slope.

Apatochernes wisei Beier, 1976: 233
HOLOTYPE ♂, wet
Mangamuka Hills, Forest summit, 382 m, 19 Nov 1966, K.A.J. Wise. Auckland Museum plant/soil sample 90, debris beaten from *Freycinetia.*
Note: Allotype in same tube.

Nesidiochernes scutulatus Beier, 1969: 415
HOLOTYPE ♀, wet
Hamilton, R. Nielson.

Phaulochernes jenkinsi Beier, 1976: 221
HOLOTYPE ♂, wet
E coast Coromandel, W side Shoe I, 21 Apr 1967, J.A.F. Jenkins. Auckland Museum plant/soil sample 273, leaf litter pohutukawa forest.
Note: Beier (1976) designated a ♂ holotype, ♀ allotype and 14 paratypes (5♂♂, 4♀♀, 5 nymphs). His vial of types (labelled "*Phaulochernes jenkinsi* det Beier, Typen") contains 9♂♂, 6♀♀ and 7 nymphs. It is impossible to determine which is the holotype.

Smeringochernes zealandicus Beier, 1976: 224
HOLOTYPE ♂, wet/dry
Tauranga Bay, Butterfly V, 28 Nov 1966, K.A.J. Wise. Auckland Museum plant/soil sample 46, rotting wood/soil.
Note: Tube contains 3 adults and 4 nymphs. It is not clear which specimen is the holotype. Types have dehydrated and been transferred to a gelatin capsule inside original vial.

Order **COLEOPTERA**

Acalles metrosiderae Broun, 1910a: 296
SYNTYPE, dry
Kermadec Is, Sunday I, W.L. Wallace.

Anacaena tepida Winterbourn, 1970: 27
HOLOTYPE ♂, wet
Taupo, Waipahihi Stm, 7 Aug 1966, M.J. Winterbourn.

Aphodius raoulensis Broun, 1910a: 295
HOLOTYPE, dry
Kermadec Is, Sunday I, W.L. Wallace. Under rotten logs.

Bountya insularis Townsend, 1971: 183
HOLOTYPE ♂, dry
Bounty Is, 11 Nov 1950, E.G. Turbott. Under stones.

Corticaria longula Broun, 1910a: 293; 1910b: 26
?SYNTYPE, dry
Kermadec Is, Sunday I, W.L. Wallace.
Note: Type status doubtful; specimen does not bear a "Broun Number" (see May, 1967).

Coxelus punctatus Broun, 1910a: 294
HOLOTYPE, dry
Kermadec Is, Sunday I, W.L. Wallace.
Note: Located in BMNH and transferred to AMNZ in 1969. The specimen formerly considered to be the holotype listed by Powell (1941) has no type status (R.D. Pope, *in litt.*, 1969) and was transferred to BMNH in exchange. The species is probably a synonym of *C. xanthonyx* Broun (det. R.D. Pope).

****Coxelus xanthonyx*** Broun, 1910a: 294
HOLOTYPE, dry
Kermadec Is, Raoul I, W.L. Wallace. In decayed *Metrosideros* in crater.
Note: Recorded missing by Powell (1941) but located in and retained by BMNH by agreement in 1969.

Duvaliomimus watti Britton, 1958: 188
HOLOTYPE ♂, dry
Auckland District, Moumoukai V, 24 Apr 1954, J.C. Watt.

Eutornopsis piceus Broun, 1910a: 300
SYNTYPE ♂, dry
Kermadec Is, Sunday I, W.L. Wallace.
Note: Specimen bears a lectotype label (det G. Kuschel, 1966) but designation not published.

Heterodoxa secreta Cameron, 1950: 25
SYNTYPES (2), dry
Off N coast NZ, Three Kings Is, Great King I, 6 Oct 1948, E.G. Turbott. Taken from leaf mould.
Note: Both specimens glued to same card rectangle. The description does not specify which is the type.

Hyphalus wisei Britton, 1973: 121
HOLOTYPE, dry
Rodney Co, N of Leigh, exposed rock platform opposite Goat I, 5 Dec 1968, K.A.J. Wise. Intertidal zone.

Laccobius mineralis Winterbourn 1970: 25
HOLOTYPE ♂, wet
Taupo, Waipuwerawera Stm, Jun 1966, M.J. Winterbourn.

Lissotes triregius Holloway, 1963: 77
HOLOTYPE ♂, dry
Three Kings Is, Great I, Hapuka Pt, NE slopes above sea, 8 May 1946, E.G. Turbott.
Note: Dissected genitalia in microvial on pin.

Menimus clarkei Kaszab, 1985: 45
HOLOTYPE, dry
Fiji, C.E. Clarke.
Note: Type repository mistakenly published as "D.S.I.R." (now NZAC).

Menimus crosbyi Watt, 1993: 47
HOLOTYPE, dry
Waipoua SF, Waimatenui, C.E. Clarke.
Note: Originally described as *M. clarkei* (Watt, 1992: 27), a junior homonym of *M. clarkei* Kaszab (see above).

****Microtribus sculpturatus*** Broun, 1910a: 300
SYNTYPE, dry
Kermadec Is, Sunday I, W.L. Wallace. Leaves of *Solanum*.
Note: One syntype located in BMNH, the other missing.

Mimopeus clarkei, Watt, 1988: 136
HOLOTYPE ♂, dry
Molesworth, Awatere R, 25 Dec 1943, C.E. Clarke.
Note: Dissected genitalia (once glued to card on pin) missing.

Mimopeus insularis Watt, 1988: 125
HOLOTYPE ♂, dry
Poor Knights Is, Tawhiti Rahi, Nov 1945, Auckland Museum.
Note: This is *Cilibe tawhitirahi* of Watt (1961, unpubl.). Description refers to ♀ holotype but specimen definitely ♂. Dissected genitalia glued to card on pin.

Mimopeus neglectus Watt, 1988: 120
HOLOTYPE ♂, dry
Wellington, Sinclair Head, 25 Apr 1942, C.E. Clarke.
Note: This is *Cilibe elongata neglecta* of Watt (1961, unpubl.). Dissected genitalia glued to card on pin.

****Mimopeus parvus*** Watt, 1988: 128
HOLOTYPE ♂, dry
Molesworth, Awatere R, 25 Dec 1943, C.E. Clarke. Under stone.
Note: No specimens of this species, including 3 paratypes recorded by Watt (1988), can be located in AMNZ.

Mimopeus turbotti Watt, 1988: 124
HOLOTYPE ♂, dry
Three Kings Is, Great I, 3 May 1946, E.G. Turbott. East division under stone near Quadrats 1 and 2.
Note: Dissected genitalia glued to card on pin.

Odontria carinata Given, 1954: 269
HOLOTYPE ♂, dry
Three Kings Is, Great I, 5 May 1946, E.G. Turbott. Depot at night.
Note: Dissected genitalia glued to card on pin.

Peniticus wallacei Broun 1910a: 301
SYNTYPE ♂, dry
Kermadec Is, Sunday I, W.L. Wallace. Under dead nikau leaves.

Pentarthrum gracilicorne Broun, 1910a: 298
SYNTYPE, dry
Kermadec Is, Sunday I, W.L. Wallace. Rotten ngaio wood.

Phaeophanus turbotti Spiller, 1942: 265
HOLOTYPE ♀, dry
Poor Knights Is, Aorangi I, 23-29 Nov 1940, E.G. Turbott.
Note: Dissected genitalia in microvial on pin.

Platypus posticus Broun, 1910a: 301
HOLOTYPE, dry
Kermadec Is, Sunday I, W.L. Wallace.

Pseudopisalia turbotti Cameron, 1950: 24
SYNTYPES (3), dry

Three Kings Is, Great I, 6 Oct 1948, E.G. Turbott. Taken from leaf mould.
Note: Three specimens are glued to the same piece of card. The description does not specify a holotype.

Psylliodes solanae Broun, 1910a: 302
SYNTYPES (1♂ 1♀), dry
Kermadec Is, Sunday I, W.L. Wallace. On the common *Solanum.*
Note: Two specimens and dissected ♂ genitalia are glued to the same piece of card.

Ptilopodius aitutakii Beaver & Maddison, 1990: 1367
HOLOTYPE ♀, dry & *slide
Cook Islands, Aitutaki, Angari Islet, 3 Sep 1969, K.A.J. Wise.
Note: Left antenna mounted on slide but not located.

Quedius subapterus Cameron 1950: 23
HOLOTYPE, dry
Three Kings Is, Great I, 6 Oct 1948. E.G. Turbott. Taken from leaf-mould.

Rhyncogonus planidorsis Broun, 1910a: 296
HOLOTYPE, dry
Kermadec Is, Sunday I, W.L. Wallace.
Note: Recorded missing by Powell (1941) but located in BMNH and transferred to AMNZ in 1969. Dissected genitalia in microvial on pin.

Salpingus lepidulus Broun, 1910a: 295
SYNTYPE, dry
Kermadec Is, Sunday I, W.L. Wallace.

Scopaeus (Polyodontus) apterus Cameron, 1950: 23
HOLOTYPE, dry
Three Kings Is, Great I, 6 Oct 1948, E.G. Turbott. Leaf-mould.

Sericospilus watti Given, 1960: 375
HOLOTYPE ♂, dry
Great Barrier I, Mt Hobson, 20 Nov 1954, J.C. Watt. Flying in evening.
Note: Dissected genitalia glued to card on pin.

Order **COLLEMBOLA**

Dicyrtomina turbotti Salmon, 1948a: 299
HOLOTYPE, slide
Three Kings Is, 4 Jun 1946, E.G. Turbott. In leaf mould under large leaf trees.

Entomobrya cuniculicola Pritchard, 1932: 135
HOLOTYPE, wet
Auckland, Manukau, Niger Bay, 6 Aug 1932, E.D. Pritchard.

Folsomides neozealandica Salmon, 1948a: 292
HOLOTYPE, slide
Three Kings Is, 4 Jun 1946, E.G. Turbott. In leaf mould under large trees.

Gnathalonche sensilla Salmon, 1948a: 291
HOLOTYPE, slide
Three Kings Is, 4 Jun 1946, E.G. Turbott. In leaf mould under large leaf trees.

Metakatianna nigraoculata Salmon, 1948a: 298
HOLOTYPE, slide
Three Kings Is, 4 Jun 1946, E.G. Turbott. In leaf mould under large trees.

Pseudosinella dispadentata Salmon, 1948a: 297
HOLOTYPE, slide
Three Kings Is, 4 Jun 1946, E.G. Turbott. In leaf mould under large trees.

Sorensia anomala Salmon, 1948a: 293
HOLOTYPE, slide
Three Kings Is, 4 Jun 1946, E.G. Turbott. In leaf mould under large trees.

Zealandanura bituberculata Deharveng & Wise, 1987: 144
HOLOTYPE, slide
Campbell I, Tucker Cove, 28 Feb 1963, K.A.J. Wise. Under timber.

Order **DERMAPTERA**

Brachylabis manawatawhi Giles, 1958: 44
HOLOTYPE ♂, dry & wet
Three Kings Is, South West I, 13 Jan 1951, E.G. Turbott. In forest near summit under stones and leaf-mould.
Note: Dissected genitalia and manubrium in alcohol, not on slide as indicated by Giles' handwritten label.

Order **DIPTERA**

Anabarhynchus wisei Lyneborg, 1992: 66
HOLOTYPE ♀, dry
Routeburn, 25 Dec 1914.
Note: Dissected genitalia in microvial on pin.

Australimyza anisotomae Harrison, 1953: 277
HOLOTYPE ♂, dry
Antipodes Is, tussock slopes above Ringdove Bay, 7 Nov 1950, E.G. Turbott.

Calliphora (Paracalliphora) kermadeca Kurahashi, 1971: 173

HOLOTYPE ♂, dry
Kermadec Is, Raoul I, Low Flat 30 m, 23 Sep-8 Oct 1962, G.A. Samuelson. Net trap, dead goat.

Calliphora (Paracalliphora) rufipes kermadecensis Kurahashi, 1971: 191
HOLOTYPE ♂, dry
Kermadec Is, Raoul I, Mt Moumoukai, 530 m, 4 Sep 1962, G.A. Samuelson.

Erioptera (Trimicra) antipodarum Alexander, 1953: 757
HOLOTYPE ♂, dry
Antipodes Is, tussock slopes above Ringdove Bay, 9 Nov 1950, E.G. Turbott.

Erioptera (Trimicra) brachyptera Alexander, 1955: 237
HOLOTYPE ♂, dry
Campbell I, 1947, J.H. Sorenson.

Helosciomyza simillima Harrison, 1959: 45
HOLOTYPE ♂, dry
Arthurs Pass, 16 Jan 1922, C.E. Clarke.

Macrocanace antipoda Harrison, 1953: 276
HOLOTYPE ♀, dry
Antipodes Is, shore of Ringdove Bay, 5 Nov 1950, E.G. Turbott. Taken in spider web.

Pericoma clarkei Satchell, 1954: 480
HOLOTYPE ♂, dry
Hump Mt, 3 Jan 1922, C.E. Clarke.

Zealandortalis philpotti Harrison, 1959: 178
HOLOTYPE ♂, dry
Auckland, 20 Oct 1929, A. Philpott.
Note: Both holotype ♂ and paratype ♀ on same pin.

Order **HEMIPTERA**

Arahura dentata Knight, 1975: 189
HOLOTYPE ♂, dry
Cuvier I, Summit, 12 Jan 1972, K.A.J. Wise. On weeds and grasses.
Note: Dissected genitalia in microvial on pin.

Atylana rarotongae Eyles & Linnavuori, 1974: 41
HOLOTYPE ♂, dry
Cook Is, Rarotonga, 2 Jan 1938, C.E.Clarke.
Note: Dissected genitalia and abdomen glued to card on pin.

Calotettix lais Eyles & Linnavuori, 1974: 40
HOLOTYPE ♂, dry
Cook Is, Rarotonga, 15 Dec 1937, C.E. Clarke.
Note: Dissected genitalia glued to card on separate pin.

Campylomma aitutaki Schuh 1984: 260
HOLOTYPE ♂, dry
Cook Is, Aitutaki, Vaipeka, 28 Aug 1969, K.A.J. Wise. Swept.

Campylomma cookensis Schuh, 1984: 272
HOLOTYPE ♂, dry
Cook Is, Aitutaki, Maina Islet, 3 Sep 1969, K.A.J. Wise.

Carystoterpa ikana Hamilton & Morales, 1992: 14
HOLOTYPE ♂, dry
Mangamuka hills, Forest summit, 19 Dec 1966, K.A.J. Wise.
Note: Dissected genitalia in microvial on pin.

Carystoterpa minima Hamilton & Morales, 1992: 15
HOLOTYPE ♀, dry
North Cape area, Kerr Pt, cliff tops, 6 Dec 1967, K.A.J. Wise. Swept.

Cermatulus turbotti Woodward, 1950b: 24
HOLOTYPE ♀, dry
Three Kings Is, Great I, Tasman V, 6 May 1946, E.G. Turbott. On tea-tree.

Chinamiris muehlenbeckiae Woodward, 1950a: 10
HOLOTYPE ♂, dry
North Island, Manawatu, Foxton, 8 Jan 1950, T.E. Woodward. On *Muehlenbeckia australis*.

Cicada aprilina Hudson, 1891: 53
SYNTYPES (2♂♂), dry
Wellington, Botanical Gardens, 7 Apr 1889, G.V. Hudson.
Note: Lectotype in NMNZ designated by Fleming & Ordish (1966) hence these specimens now paralectotypes.

Cicada iolanthe Hudson, 1891: 53
SYNTYPE ♀, dry
Wellington, Karori, Dec 1890, G.V. Hudson.

Cicada muta var. ***minor*** Hudson, 1891: 52
LECTOTYPE ♂, dry
Wellington, Cape Terewhiti, 15 Dec 1889, G.V. Hudson.
Note: Lectotype designation by Fleming & Ordish (1966).

Cicada tristis Hudson, 1891: 52
SYNTYPE ♀, dry
Wellington, Botanical Gardens, Feb 1889, G.V. Hudson.

Clavaptera ornata Kirman, 1985: 126
HOLOTYPE ♂, dry
North Cape area, 4 miles from Spirits Bay Rd, Serpentine Access Rd, 30 Apr 1968, J. Bertrand. Auckland Museum plant/soil sample 526, leaf litter.

Ctenoneurus pendergrasti Kormilev, 1971: 58
HOLOTYPE ♀, dry
Tarawera, 14 Oct 1935, O.M. Swezey.

Ctenoneurus setosus Lee & Pendergrast, 1977: 168
HOLOTYPE ♂, dry
Kawakawa, Waiomio Caves area, 24 Sep 1956, R.A. Crowson. On fruit bodies of fungus *Daldinia* sp.

Cymus novaezelandiae Woodward, 1954: 224
HOLOTYPE ♂, dry
Manawatu, Paiaka, 9 Jan 1950, T.E. Woodward.

Cyrtorhinus cumberi Woodward, 1950a: 16
HOLOTYPE ♂, dry
Manawatu, Paiaka, 4 Jan 1950, T.E. Woodward. Tufts of rushes and grasses.

Deraeocoris maoricus Woodward, 1950a: 12
HOLOTYPE ♂, dry
Nelson, Botanical Reserve, 11 Dec 1949, T.E. Woodward.

Euacanthella brunnea Evans, 1966: 143
HOLOTYPE ♀, dry
Auckland, Portland Rd, 20 Mar 1956, K.D. Hill.

Isodermus maculosus Pendergrast, 1965: 237
HOLOTYPE ♂, dry
Waitati, 25 Oct 1925, C.E. Clarke.

Modicarventus wisei Kirman, 1989: 27
HOLOTYPE ♀, dry
North Cape area, Unuwhao, 610 m, 22 Feb 1967, K.A.J. Wise. Auckland Museum plant/soil sample 218, forest remnant.

Oiophysa fuscata pendergrasti Woodward, 1956: 49
HOLOTYPE ♂, dry
Coromandel Pen, ridge to Little Moehau, 24 Oct 1954, J.G. Pendergrast. Ex moss, *Weinmannia* forest.
Note: Dissected genitalia, abdomen and wing enclosed between two coverslips on pin.

Rhopalimorpha (Lentimorpha) alpina Woodward, 1953a: 304
HOLOTYPE ♀, dry
Southland, McKinnon Pass, 28 Dec 1919, C.E. Clarke.
Note: Dissected genitalia in microvial on pin.

Rhopalimorpha lineolaris Pendergrast, 1950: 32
HOLOTYPE ♀, dry
Auckland, Orakei, 8 Jul 1950. On *Carex longifolia.*

Sthenarus myersi Woodward, 1950a: 22
HOLOTYPE ♂, dry
Manawatu, Foxton, 8 Jan 1950, T.E. Woodward. On *Muehlenbeckia australis.*
Note: Dissected genitalia in microvial on pin.

Tomocoris insularis Woodward, 1953b: 213
HOLOTYPE ♀, dry
Three Kings Is, Great I, Castaway V, 15 Jan 1951, T.E. Woodward. In leaf-mould under sedges beside Castaway Stm.
Note: Dissected genitalia in microvial on pin.

Trypetocoris aucklandensis Woodward, 1953b: 217
HOLOTYPE ♂, dry
N Auckland, Waipoua Forest, Jan 1952, W.R. McGregor. Leaf-mould.
Note: Dissected genitalia in microvial on pin.

Trypetocoris separatus Woodward, 1953b: 218
HOLOTYPE ♂, dry
N Auckland, Matakana, Tamahanga Hill, 30 Mar 1938, C.E. Clarke.

Ugyops (Paracona) pelorus Fennah 1965: 11
HOLOTYPE ♂, dry
Whakatane Co, Ohope beach, 22 Jan 1947, C.R. Pattison.

Order **ISOPTERA**

Calotermes (Calotermes) curvithorax Kelsey, 1943: 45
SYNTYPES, wet (2 tubes)
Phoenix Group, Canton I, 30 May 1949, G.A. Buddle. From log of wood on beach.
Note: One tube contains 29 specimens (1 soldier, 28 nymphs) and many eggs, the other 1 alate adult. Published information records wings on 2 slide mounts but not located.

Order **LEPIDOPTERA**

Adeixis parvitis Howes, 1917: 274
HOLOTYPE ♂, dry
Dunedin, Broad Bay, 18 Dec 1915, C.E. Clarke.

Aletia empyrea Hudson, 1918: 61
LECTOTYPE ♀, dry
Routeburn V, 25 Dec 1914, C.E. Clarke.
Note: Lectotype designation by Dugdale (1988).

Antipodesma turbotti Salmon & Bradley, 1956: 65
HOLOTYPE ♂, dry & 2 slides (19/53, 19/54)
Antipodes Is, tussock slopes above Ringdove Bay, 6 Nov 1950, E.G. Turbott.
Note: Genitalia and wings mounted on separate microscope slides.

Apatetris nivea Philpott, 1930: 7
HOLOTYPE ♂, dry
Auckland, 12 Jan 1919, C.E. Clarke.

Archyala culta Philpott, 1931: 35
HOLOTYPE ♂, dry
Dunedin, Opoho, 17 Dec 1921, C.E. Clarke.

Archyala tigrina Philpott, 1930: 15
HOLOTYPE ♂, dry
Whangarei, Waikaraka V, 16 Jan 1927, C.E. Clarke.

Astrogenes insignita Philpott, 1930: 16
HOLOTYPE ♂, dry
Whangarei, Waikaraka V, 17 Jan 1927, C.E. Clarke Collection.
Note: Locality labels do not agree with the published information - see Dugdale (1988: 60).

Batrachedra astricta Philpott, 1930: 14
HOLOTYPE ♂, dry
Dunedin, Opoho, 17 Dec 1921, C.E. Clarke.

Borkhausenia clarkei Philpott, 1928: 366
HOLOTYPE ♂, dry
Auckland, Kauri Gully, 3 Jan 1921, C.E. Clarke.

Borkhausenia lassa Philpott, 1930: 9
HOLOTYPE ♂, dry
Dunedin, Leith, 1 Dec 1915, C.E. Clarke.

Borkhausenia laudata Philpott, 1930: 9
HOLOTYPE ♂, dry
Bluecliff, 4 Jan 1922, C.E. Clarke.

Borkhausenia levicula Philpott, 1930: 8
HOLOTYPE ♂, dry
L Manapouri, Hunter Mts, Flat Mt, 4000', 28 Dec 1928, C.E. Clarke.

Capua variegata Philpott, 1930: 4
HOLOTYPE ♂, dry
Wairakei, 31 Dec 1916, C.E. Clarke.
Note: Dissected abdomen in microvial on pin.

Carposina literata Philpott, 1930: 11
HOLOTYPE ♂, dry
Franz Josef Glacier, Defiance Hut, 2600', 20 Jan 1925, C.E. Clarke.

Carposina marginata Philpott, 1931: 33
HOLOTYPE ♂, dry
Okoroire, 26 Dec 1920, C.E. Clarke.

Carposina sanctimonea Clarke, 1926: 418
HOLOTYPE ♀, dry
Arthurs Pass, c. 3500', 16 Jan 1922, C.E. Clarke.
Note: Found since Powell (1941) recorded it missing.

Choroclystis clarkei Howes, 1917: 274
HOLOTYPE ♀, dry
Dunedin, Flagstaff Hill, 8 Mar 1915, C.E. Clarke.

Crambus corylana Clarke, 1926: 417
HOLOTYPE ♂, dry
Central Otago, Mt Ida, 19 Feb 1922, C.E. Clarke.

Ctenopseustis fraterna Philpott, 1930: 7
HOLOTYPE ♂, dry
Whangarei, 11 Jan 1921, C.E. Clarke.
Note: Dissected abdomen in gelatin capsule on separate pin.

Ctenopseustis obliquana distincta Salmon, 1948c: 311
HOLOTYPE ♂, dry
Three Kings Is, Great I, Tasman V, 23 Apr 1946, E.G. Turbott. On tea tree.
Note: Dissected abdomen in microvial on pin.

Elachista stellata Philpott, 1931: 31
HOLOTYPE ♂, dry
Pembroke, 23 Dec 1923, C.E. Clarke.

Epichorista candida Clarke, 1926: 419
HOLOTYPE ♀, dry
L Manapouri, Hope Arm, 4 Jan 1923, C.E. Clarke Collection.
Note: Abdomen in gelatin capsule on pin.

Epichorista mimica Philpott, 1930: 5
HOLOTYPE ♂, dry

Central Otago, Mt Ida, 19 Feb 1922, C.E. Clarke.
Note: Abdomen in microvial on pin.

Epichorista tenebrosa Philpott, 1917: 243
HOLOTYPE ♂, dry
Ben Lomond, 23 Feb 1916, C.E. Clarke.
Note: Abdomen in microvial on separate pin.

****Epithectis transversella*** Hudson, 1939: 438
HOLOTYPE ♀, dry
Auckland Domain, 10 Mar 1934, C.E. Clarke.

Gelechia calaspidea Clarke, 1934: 14
HOLOTYPE ♂, dry
L Manapouri, Hunter Mts, Flat Mt, 4000', 28 Dec 1928, C.E. Clarke.

Gelechia contraria Philpott, 1930: 8
HOLOTYPE ♂, dry
Westland, Waiho R, 17 Jan 1925, C.E. Clarke.

Gelechia parvula Philpott, 1930: 7
HOLOTYPE ♂, dry
L Manapouri, Hope Arm, 7 Jan 1923, C.E. Clarke.

Gelophaula aridella Clarke, 1934: 13
HOLOTYPE ♂, dry
L Manapouri, Hunter Mts, Flat Top Mt, 5 Jan 1923, C.E. Clarke.

Glyphipteryx barbata Philpott, 1918: 130
HOLOTYPE ♂, dry
Dunedin, Waitati, 5 Nov 1916, C.E. Clarke.

Glyphipteryx scintilla Clarke, 1926: 420
HOLOTYPE ♂, dry
L Manapouri, Hunter Mts, Flat Mt, 4000', 5 Jan 1923, C.E. Clarke.

Gymnobathra aurata Philpott, 1931: 32
HOLOTYPE ♂, dry
Dunedin, Opoho, 30 Nov 1921, C.E. Clarke.

Gymnobathra nigra Philpott, 1930: 9
HOLOTYPE ♂, dry
W of L Te Anau, Kepler Mts, 4000', 3 Jan 1925, C.E. Clarke.

Gymnobathra zephyrana Clarke, 1926: 419
HOLOTYPE ♂, dry
Whangarei, 11 Jan 1921, C.E. Clarke. In forest.

Heliostibes barbarica Philpott, 1930: 12
HOLOTYPE ♂, dry
Whangarei, 11 Jan 1921, C.E. Clarke.

Heliostibes bilineata Salmon, 1948c: 310
HOLOTYPE, dry
Three Kings Is, Great I, 24 Apr 1946, E.G. Turbott. From flowering kanuka trees.

Hydriomena callichlora harmonica Clarke, 1926: 417
HOLOTYPE ♂, dry
Waitati Bush nr Dunedin, 7 Nov 1917, C.E. Clarke.

Ichneutica cana Howes, 1914: 96
HOLOTYPE ♂, dry
Garvie Mts, 20 Nov 1910, W.G. Howes
Note: Published locality and date (Hector Mts, 20 Nov 1911) disagree with label (Garvie Mts, 20 Nov 1910).

Izatha toreuma Clarke, 1926: 419
HOLOTYPE ♀, dry
Arthurs Pass, 3500', 23 Jan 1922, C.E. Clarke.

Leptocroca aquilonaris Philpott, 1931: 31
HOLOTYPE ♂, dry
Auckland, Kauri Gully, 26 Jan 1921, C.E. Clarke.

Leptocroca lenita Philpott, 1931: 32
HOLOTYPE ♂, dry
Buller Gorge nr Newtons Flat, 29 Dec 1918, G.V. Hudson.

Leucania hartii Howes, 1914: 95
HOLOTYPE ♂, dry
Cape Egmont lighthouse, 20 Apr 1911, S. Hart.
Note: Published sex (♀) and date (20 Mar 1911) do not agree with specimen and label.

Locheutis fusca Philpott, 1930: 11
HOLOTYPE ♂, dry
Tongariro National Park, 16 Jan 1930, A. Philpott.

Lysiphragma argentaria Salmon, 1948c: 310
HOLOTYPE ♂, dry
Three Kings Is, Great I, 22 Apr 1946, E.G. Turbott. On tea tree after rain.

Mallobathra cataclysma Clarke, 1934: 15
HOLOTYPE ♀, dry
Upper Routeburn R, Harris saddle, 20 Jan 1926, C.E. Clarke. On bark of *Nothofagus*.

****Mallobathra memotuina*** Clarke, 1934: 14

HOLOTYPE ♂, dry
Dunedin, Anderson's Bay, Vauxhall cliff, Nov & Dec, 1928 & 1929, C.E. Clarke.
Note: Not located by Dugdale (1988)

Mallobathra nocturna Clarke, 1926: 421
HOLOTYPE ♂, dry
Auckland, Northcote, Kauri Gully, 10 Jan 1919, C.E. Clarke.
Note: Published date (Jan 1921) does not agree with label.

Mecyna antipodea Salmon & Bradley, 1956: 77
HOLOTYPE ♂, dry
Antipodes Is, above Ringdove Bay, 9 Nov 1950, E.G. Turbott. Tussock.

Melanchra dives Philpott, 1930: 1
HOLOTYPE ♂, dry
Dunedin, Flagstaff Hill, 23 Oct 1914, C.E. Clarke.

Morrisonia longstaffii Howes, 1911: 128
HOLOTYPE ♂, dry
Dunedin, Tomahawk, 22 Mar 1907, W.G. Howes
Note: Not listed by Powell (1941) and thought lost. Lectotype ♂ designated by Dugdale (1988: 200) in BMNH.

Morrisonia pascoei Howes, 1912: 205
HOLOTYPE ♀, dry
Orepuki, 1 Sep 1910, W.G. Howes.
Note: Not listed by Powell (1941). Dugdale (1988: 207 and pers. comm.) designated a lectotype ♂ believing Howes' types a syntype series. All are labelled "co-type" except the ♀ from Orepuki where the "co" appears to have been deliberately crossed out. This accords with Howes' practice with other species where he designated a type and cotypes, not an undifferentiated syntype series. Whatever the status of the putative holotype and lectotype, the entire type series is in the AMNZ.

Morrisonia praesignis Howes, 1911: 128
HOLOTYPE ♀, dry
Orepuki, 1 Oct 1910, W.G. Howes.
Note: Recorded as a ♂ in Howes' original description. Not listed by Powell (1941).

Morrisonia sequens Howes, 1912: 204
HOLOTYPE ♀, dry
North Island, Whakarewarewa, 15 Feb 1910, G.B. Longstaff.
Note: Not seen by Dugdale (1988).

Nepticula lucida Philpott, 1919: 225
HOLOTYPE ♂, dry
Dunedin, Waitati, 3 Nov 1917, C.E. Clarke. Beaten from foliage of *Nothofagus.*

Nyctemera annulata antipodea Salmon & Bradley, 1956: 64

HOLOTYPE ♂, dry
Antipodes Is, Ringdove Bay, 10 Nov 1950, E.G. Turbott. Reared from larva collected on *Senecio antipodus*.

Orocrambus clarkei Philpott, 1930: 3
HOLOTYPE ♂, dry
Franz Josef, Mt Moltke, 4000-5000', 20 Jan 1925, C.E. Clarke.

Orocrambus lindsayi Gaskin, 1975: 324
HOLOTYPE ♀, dry
Mt Ida, 19 Feb 1922, C.E. Clarke.
Note: Dissected genitalia in microvial on separate pin.

Orocrambus ordishi Gaskin, 1975: 327
HOLOTYPE ♂, dry
Hinds, 13 Mar 1911, C.E. Clarke.
Note: Dissected genitalia in microvial on separate pin (ALZ).

Orthenches disparilis Philpott, 1931: 34
HOLOTYPE ♂, dry
Auckland, Kauri Gully, 27 Jan 1921, C.E. Clarke.

Orthenches septentrionalis Philpott, 1930: 14
HOLOTYPE ♂, dry
Auckland, Kauri Gully, 10 Jan 1919, C.E. Clarke.

Porina unimaculata Salmon, 1948c: 309
HOLOTYPE ♂, dry & 2 slides
Three Kings Is, Great I, 24 Apr 1946, E.G. Turbott. At light.
Note: Abdominal tergites, sternites and dissected genitalia mounted on 2 slides.

Pseudocoremia maculosa Howes, 1914: 96
HOLOTYPE ♂, dry
Whakatipu district, Queenstown, 20 Nov 1910, M.O. Pasco.

Pyrgotis humilis Philpott, 1930: 4
HOLOTYPE ♂, dry
Otago, Mt Maungatua, 2 Dec 1923, C.E. Clarke.
Note: Dissected abdomen in microvial on pin.

Pyrgotis modesta Philpott, 1930: 4
HOLOTYPE ♂, dry
Westland, Waiho Gorge, 16 Jan 1925, C.E. Clarke.
Note: Dissected genitalia in microvial on pin.

Sabatinca abyssina Clarke, 1934: 15

HOLOTYPE ♂, dry
Westland, NE side of Franz Josef Glacier, 23 Jan 1925, C.E. Clarke. On rough, ice-worn rocks.

Sabatinca lucilia Clarke, 1920: 35
HOLOTYPE, dry
Auckland, Kauri Gully, 10 Jan 1919, C.E. Clarke. Sunny moss covered clay bank.

Scoparia contexta Philpott, 1931: 28
HOLOTYPE ♂, dry
Franz Josef Glacier, Mt Moltke, 5000', 20 Jan 1925, C.E. Clarke.

Scoparia famularis Philpott, 1930: 3
HOLOTYPE ♀, dry
S Arm of L Te Anau, Kepler Mts, 3500', 3 Jan 1925, C.E. Clarke.

Scoparia illota Philpott, 1919: 224
HOLOTYPE ♂, dry
Wairaurahiri R, 12 Dec 1917.
Note: Recorded missing by Dugdale (1988: 161).

Scoparia sylvestris Clarke, 1926: 418
HOLOTYPE ♀, dry
Westland, Otira R, 30 Jan 1922, C.E. Clarke.

Scoparia tuicana Clarke, 1926: 418
HOLOTYPE ♂, dry
Waitati, 7 Dec 1918, C.E. Clarke.

Scythris nigra Philpott, 1931: 31
HOLOTYPE ♂, dry
Mt Maungatua, 21 Dec 1924, C.E. Clarke.

Selidosema insignita Philpott, 1930: 2
HOLOTYPE ♂, dry
Kaeo, 16 Jan 1921, C.E. Clarke.
Note: Wings in paper triangle attached to pin.

Selidosema pergrata Philpott, 1930: 2
HOLOTYPE ♂, dry
Otago, Sandymount, 26 Feb 1922, C.E. Clarke.

Simaethis chatuidea Clarke, 1926: 421
HOLOTYPE ♂, dry
Dunedin, Andersons Bay, 19 Nov 1921, C.E. Clarke.
Note: Published date (Nov 1923) and label disagree.

Simaethis fasciata Philpott, 1930: 13
HOLOTYPE ♂, dry
Arthurs Pass, 24 Jan 1923, C.E. Clarke.

Simaethis inspoliata Philpott, 1930: 12
HOLOTYPE ♂, dry
L Manapouri, Hunter Mts, Flat Mt, 4000', 28 Dec 1928, C.E. Clarke.

Simaethis tristis Philpott, 1930: 12
HOLOTYPE ♂,dry
Tongariro National Park, slopes of Mt Ruapehu, 16 Jan 1930, A. Philpott.

Simaethis urbana Clarke, 1926: 420
HOLOTYPE ♂, dry
Arthurs Pass, 4000', 21 Jan 1922, C.E. Clarke. On open mountainside.

Stathmopoda albimaculata Philpott, 1931: 33
HOLOTYPE ♀, dry
Taieri, Woodside, 16 Dec 1923, C.E. Clarke.

Stathmopoda seminuda Philpott, 1917: 244
HOLOTYPE ♂, dry
Dunedin, Broad Bay, 28 Nov 1915, C.E. Clarke.

Talaeporia triangularis Philpott, 1930: 16
HOLOTYPE ♂, dry
Hump Mt, 2 Jan 1922, C.E. Clarke.

Tanaoctena dubia Philpott, 1931: 34
HOLOTYPE ♂, dry
Auckland, 8 Jan 1919, C.E. Clarke.

Tatasoma monoviridisata Clarke, 1920: 35
HOLOTYPE ♂, dry
Waitati, 12 Nov 1916, C.E. Clarke. Beaten from *Coriaria.*
Note: Published dates (1918, 1919) and label (1916) disagree.

Tauroscopa nebulosa Philpott, 1930: 3
HOLOTYPE ♂, dry
L Wanaka, Minaret Pk, 30 Dec 1923, C.E. Clarke.

Tinea aerata Philpott, 1930: 15
HOLOTYPE ♀, dry
Tongariro National Park, 16 Jan 1930, A. Philpott.

Tinea aetherea Clarke, 1926: 421
HOLOTYPE ♂, dry
Arthurs Pass, 3500', 26 Jan 1923, C.E. Clarke.

Tinea conspecta Philpott, 1931: 35
HOLOTYPE ♂, dry
Auckland Domain, 21 Apr 1929, A. Philpott.
Note: Published date (November) and label (April) disagree.

Tinea furcillata Philpott, 1930: 15
HOLOTYPE ♂, dry
Dunedin, Andersons Bay, 8 Nov 1922, C.E. Clarke.

Tortrix clarkei Philpott, 1930: 5
HOLOTYPE ♂, dry
Waimarino, 24 Jan 1919, C.E. Clarke.
Note: Dissected abdomen in microvial on pin.

Tortrix cuneata Clarke, 1926: 419
HOLOTYPE ♂, dry
L Manapouri, Hope Arm, 7 Jan 1923, C.E. Clarke. In glade of beech forest.
Note: Dissected abdomen in microvial on pin.

Tortrix encausta Philpott, 1930: 6
HOLOTYPE ♂, dry
Kaeo, 16 Jan 1921, C.E. Clarke.
Note: Dissected abdomen in microvial as indicated by label not located.

Tortrix indomita Philpott, 1930: 6
HOLOTYPE ♂, dry
Dunedin, Woodhaugh, 13 Dec 1918, C.E. Clarke.
Note: Dissected abdomen in microvial on separate pin.

Tortrix inusitata Philpott, 1919: 225
HOLOTYPE ♂, dry
Dunedin, Waitati, 14 Oct 1917, C.E. Clarke.
Note: Dissected abdomen in microvial on pin.

Trachypepla festiva Philpott, 1930: 10
HOLOTYPE ♂, dry
Whangarei Falls, 5 Jan 1927, C.E. Clarke.

Trachypepla metallifera Philpott, 1928: 368
HOLOTYPE ♂, dry
Waimarino, 24 Jan 1919, C.E. Clarke.

Trachypepla minuta Philpott, 1931: 33
HOLOTYPE ♂, dry
Auckland Domain, 29 Dec 1929, A. Philpott.

Trachypepla nimbosa Philpott, 1930: 10
HOLOTYPE ♂, dry
Auckland, Kauri Gully, 13 Jan 1919, C.E. Clarke.

Xanthorhoe citroena Clarke, 1934: 11
HOLOTYPE ♂, dry
Westland, Waiho Gorge, 13 Jan 1925, C.E. Clarke. At edge of Franz Josef Glacier.

Xanthorhoe glaciata Hudson, 1925: 220
HOLOTYPE ♂, dry
S Westland, Franz Josef Glacier, Mt Moltke, 5600', 20 Jan 1925, C.E. Clarke.

Xanthorhoe ida Clarke, 1926: 417
HOLOTYPE ♂, dry
Central Otago, Mt Ida, 19 Feb 1922, W.G. Howes.
Note: Published date (1923) disagrees with label (1922).

Zelleria maculata Philpott, 1930: 13
HOLOTYPE ♂, dry
Otago, Mt Maungatua, 1 Jan 1925, C.E. Clarke.

Order **ODONATA**

Xanthocnemis sinclairi Rowe, 1987: 95
HOLOTYPE ♂, wet
Whitcombe Pass, 11 Feb 1971, M. Woodward. Tarn.
Note: Allotype in same tube.

Xanthocnemis tuanuii Rowe, 1981: 205
HOLOTYPE ♂, wet
Chatham I, Peat Stm E of Tuku Base, 22 Jan 1980, R.J. Rowe. *In copula,* brown water, forest stream.
Note: Allotype in same tube.

Order **ORTHOPTERA**

Gymnoplectron giganteum Richards, 1962: 205
HOLOTYPE ♂, wet
Poor Knights Is, 22-29 Nov 1940, E.G. Turbott.
Note: Dissected genitalia in enclosed vial.

Hemideina gigantea Colenso, 1882: 278
HOLOTYPE ♀, dry
Bay of Islands, behind Paihia, 1838, Colenso. In small low wood.
Note: No original Colenso labels survive. There is some doubt about this specimen's status but circumstantial evidence points to it being Colenso's type.

Pachyrhamma fusca Richards, 1959a: 29
HOLOTYPE ♂, wet
Thames, 1958, A.M. Richards. Gold-mining tunnels.

Pachyrhamma longicauda Richards, 1959b: 329
HOLOTYPE ♂, wet
Taumarunui
Note: Dissected subgenital plate in enclosed vial.

Pachyrhamma uncata Richards, 1959a: 32
HOLOTYPE ♂, wet
Thames, 26 Apr 1958, A.M. Richards. Ex goldmine.
Note: Dissected subgenital plate in enclosed vial.

Pachyrhamma waitomoensis Richards, 1958: 702
HOLOTYPE ♂, wet
Waitomo, Aranui Cave, 8 Mar 1955, A.M. Richards.
Note: Dissected subgenital plate in enclosed vial.

Pallidoplectron turneri Richards, 1958: 703
HOLOTYPE ♂, wet
Waitomo, Tunnel Glow Worm Cave, 22 Jan 1956, A.M. Richards.

Paraneonetus multispinus Salmon, 1948b: 306
SYNTYPES (1♂ 1♀), dry
Three Kings Is, Great I, 29 Apr 1946, E.G. Turbott.

Turbottoplectron unicolor Salmon, 1948b: 303
HOLOTYPE ♂, dry
Three Kings Is, Great I, 29 Apr 1946, E.G. Turbott.

Order **PHASMATODEA**

Acanthoxyla senta Salmon, 1948b: 301
SYNTYPES (1♂ 1♀), dry
Three Kings Is, Great I, Quadrat I, 6 May 1948, E.G. Turbott. Taken together on *Litsea.*

Order **PLECOPTERA**

Notonemoura cowleyi Winterbourn, 1965: 278
HOLOTYPE ♂, wet
Westland, Kumara, 24 Jan 1964, D.R. Cowley.

Spaniocercoides fimbria Winterbourn, 1965: 280
HOLOTYPE ♂, wet
Wellington, Khandallah Domain, 29 Dec 1963, M.J. Winterbourn.

Zelandobius pallidus Winterbourn, 1965: 275
HOLOTYPE ♂, wet
Little Barrier I, Awaroa Stm, 30 Aug 1963, M.J. Winterbourn.

Zelandoperla maculata (Hare, 1910: 29) Winterbourn, 1965: 260
NEOTYPE ♂, wet
Swanson, 22 Sep 1963, M.J. Winterbourn.

Order **TRICHOPTERA**

Alloecentrella magnicornis Wise, 1958: 53
HOLOTYPE ♂, dry & wet
Waitakere, 28 Oct 1934, C.E. Clarke.
Note: Dissected genitalia in alcohol.

Costachorema notoptera Wise, 1972: 253
HOLOTYPE ♂, wet & slide
Auckland Is, SE Enderby I, 17 Jan 1963, K.A.J. Wise. Ex pond stream, 10.30pm - 12 midnight.
Note: Right wings mounted on slide.

Diplectrona bulla Wise, 1958: 56
HOLOTYPE ♂, dry & wet
Waimarino, 27 Jan 1919, C.E. Clarke.
Note: Dissected genitalia in alcohol.

Ecnomina zealandica Wise, 1958: 57
HOLOTYPE ♀, dry & wet
Kauri Gully, 13 Jan 1919, C.E. Clarke.
Note: Dissected genitalia in alcohol.

Edpercivalia harrisoni Wise, 1982: 150
HOLOTYPE ♂, dry & wet
Fiordland National Park, Murchison Mts, Plateau Ck, 990 m, 2 Dec 1980, R.M. Emberson & C.A. Muir. On rock at night.
Note: Dissected genitalia in alcohol.

Hydrobiosis falcis Wise, 1958: 58
HOLOTYPE ♂, dry & wet
Whakapapanui Stm, 3500', 19 Oct 1949, E.G. Turbott. At light.
Note: Dissected genitalia in alcohol.

Neobiosella irrorata Wise, 1958: 58
HOLOTYPE ♀, dry
Whangarei, 7 Jan 1927, C.E. Clarke.

Oeconesus lobatus Wise, 1958: 51
HOLOTYPE ♂, dry & wet
Raurimu, 16 Jan 1919, C.E. Clarke.
Note: Dissected genitalia in alcohol.

Olinga fumosa Wise, 1958: 52
HOLOTYPE ♂, dry & wet
Waitati, 28 Nov 1917, C.E. Clarke.
Note: Dissected genitalia in alcohol.

Polyplectropus penicillus Wise, 1958: 57
HOLOTYPE ♂, dry & wet
Dunedin, 22 Nov 1916, C.E. Clarke.
Note: Dissected genitalia in alcohol.

Pseudoeconesus bistirpis Wise, 1958: 52
HOLOTYPE ♂, dry & wet
Tongariro, 16 Jan 1930, A. Philpott.
Note: Dissected genitalia in alcohol.

Pseudoeconesus tristirpis Wise, 1958: 52
HOLOTYPE ♂, dry & wet
Tongariro, 16 Jan 1930, A. Philpott.
Note: Dissected genitalia in alcohol.

Psilochorema embersoni Wise, 1982: 149
HOLOTYPE ♂, dry & wet
Fiordland National Park, Murchison Mts, E McKenzie Burn, 1110 m, 8 Dec 1980, R.M. Emberson & C.A. Muir. *Celmisia* leaf.
Note: Dissected genitalia in alcohol.

Pycnocentrodes aeris Wise, 1958: 50
HOLOTYPE ♂, dry & wet
Kinloch, 15 Jan 1926, C.E. Clarke.
Note: Dissected genitalia in alcohol.

Pycnocentrodes unicolor Wise, 1958: 50
HOLOTYPE ♂, dry & wet
Hump Mt, 2 Jan 1922, C.E. Clarke.
Note: Dissected genitalia in alcohol.

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REFERENCES

ALEXANDER, C.P.
1953 New or little-known Tipulidae (Diptera) - 95. Oriental-Australasian species. *Annals and Magazine of Natural History* (12) 6:739-757.
1955 The crane-flies of the subantarctic islands of New Zealand (Diptera). *Records of the Dominion Museum, Wellington* 2(4):233-239.

ARCHEY, G.
1936 Revision of the Chilopoda of New Zealand. *Records of the Auckland Institute and Museum* 2(1):43-70. Pls 11-15.

BEAVER, R.A. and P.A. MADDISON
1990 The bark and ambrosia beetles of the Cook Islands and Niue (Coleoptera: Scolytidae and Platypodidae). *Journal of Natural History* 24:1365-1375.

BEIER, M.
1969 Additional remarks to the New Zealand Pseudoscorpionoidea. *Records of the Auckland Institute and Museum* 6(4-6):413-418.
1976 The pseudoscorpions of New Zealand, Norfolk and Lord Howe. *New Zealand Journal of Zoology* 3:199-246.

BENHAM, W.B.
1942 *Notoscolex equestris,* an earthworm from the Poor Knights Islands. *Transactions and Proceedings of the Royal Society of New Zealand* 72:220-225.

BRITTON, E.B.
1958 The New Zealand genus *Duvaliomimus* Jeannel (Coleoptera: Carabidae). *Proceedings of the Royal Entomological Society of London* (B) 27(11-12):183-188.
1973 *Hyphalus wisei* sp. n., a new intertidal beetle from New Zealand (Coleoptera: Limnichidae). *Records of the Auckland Institute and Museum* 10:119-122.

BROUN, T.
1910a On the Coleoptera of the Kermadec Islands. *Transactions and Proceedings of the New Zealand Institute* 42:291-306.
1910b Descriptions of new genera and species of Coleoptera, Parts 1-8. *New Zealand Institute Bulletin* 1:1-708.

CAMERON, M.
1950 New species of New Zealand Staphylinidae (Col.). *Entomologists Monthly Magazine* 86:23-26.

CLARKE, C.E.
1920 New Lepidoptera. *Transactions and Proceedings of the New Zealand Institute* 52:35
1926 New species of Lepidoptera. *Transactions and Proceedings of the New Zealand Institute* 56:417-421.
1934 Notes and description of New Zealand Lepidoptera. *Transactions and Proceedings of the Royal Society of New Zealand* 64(1):11-16.

COLENSO, W.
1882 On some new and undescribed species of New Zealand insects, of the orders Orthoptera and Coleoptera. *Transactions and Proceedings of the New Zealand Institute* 14:777-282

DEHARVENG, L. and K.A.J. WISE
1987 A new genus of Collembola (Neanuridae: Neanurinae) from southern New Zealand. *Records of the Auckland Institute and Museum* 24:143-146.

DUGDALE, J.S.
1988 Lepidoptera - annotated catalogue, and keys to family-group taxa. *Fauna of New Zealand* 14:1-262.

EVANS, J.W.
1966 The leaf-hoppers and frog-hoppers of Australia and New Zealand (Homoptera: Cicadelloidea and Cercopoidea). *Memoirs of the Australian Museum* 12:1-347.

EYLES, A.C. and R. LINNAVUORI
1974 Cicadellidae and Issidae (Homoptera) of Niue Island, and material from the Cook Islands. *New Zealand Journal of Zoology* 1(1):29-44.

FENNAH, R.G.
1965 Delphacidae from Australia and New Zealand (Homoptera: Fulgoroidea). *Bulletin of the British Museum (Natural History) Entomology* 17(1):1-59.

FLEMING, C.A. and R.G. ORDISH
1966 Type specimens of G.V. Hudson's taxa of New Zealand cicadas (Genus *Melampsalta*: Hemiptera Homoptera). *Records of the Dominion Museum, Wellington* 5(20):195-200.

FORSTER, R.R.
1948 A new sub-family and species of New Zealand Opiliones. *Records of the Auckland Institute and Museum* 3(4-5):313-318.
1955 Spiders from the subantarctic islands of New Zealand. *Records of the Dominion Museum, Wellington* 2(4):167-203.
1968 Ctenizidae, Dipluridae. Pp 1-73, 126-180 *In* FORSTER, R.R. and WILTON, C.L. The spiders of New Zealand. Part II. *Otago Museum Bulletin* 2:1-180.
1970 The spiders of New Zealand. Part III. *Otago Museum Bulletin* 3:1-184.

FORSTER, R.R. and A.D. BLEST
1979 The spiders of New Zealand. Part V. *Otago Museum Bulletin* 5:1-173.

FORSTER, R.R. and C.L. WILTON
1973 The spiders of New Zealand. Part IV. *Otago Museum Bulletin* 4:1-309.

GASKIN, D.E.
1975 Revision of the New Zealand Crambini (Lepidoptera: Pyralidae: Crambinae). *New Zealand Journal of Zoology* 2(3):265-363.

GILES, E.T.
1958 Dermaptera from the Three Kings Islands, New Zealand, with the description of a new species of *Brachylabis* Dohrn (Labiduridae). *Records of the Auckland Institute and Museum* 5(1-2):43-48.

GIVEN, B.B.
1954 Melolonthinae (Coleoptera) from the Three Kings Islands. *Records of the Auckland Institute and Museum* 4(5):267-270.
1960 The Melolonthinae (Coleoptera) of New Zealand. Descriptions of new species, notes on types, and a catalogue. *New Zealand Journal of Science* 3(3):363-381.

HAMILTON, K.G.A. and C.F. MORALES
1992 Cercopidae (Insecta: Homoptera). *Fauna of New Zealand* 25:1-37.

HARE, E.J.
1910 Some additions to the Perlidae, Neuroptera-Planipennia, and Trichoptera of New Zealand. *Transactions and Proceedings of the New Zealand Institute* 42:29-33.

HARRISON, R.A.
1953 The Diptera of the Antipodes and the Bounty Islands. *Transactions and Proceedings of the New Zealand Institute* 81(2):269-282.
1959 Acalypterate Diptera of New Zealand. *New Zealand Department of Scientific and Industrial Research Bulletin* 128:1-382.

HELSON, G.A.H.
1935 *Spirotrichosoma magna* (n.sp.) from a New Zealand termite. *Transactions and Proceedings of the Royal Society of New Zealand* 64(3):251-256.

HOLLOWAY, B.A.
1963 A new species of *Lissotes* Westwood from New Zealand, and a description of the female of *L. oconnori* Holloway (Coleoptera: Lucanidae). *Transactions of the Royal Society of New Zealand, Zoology* 3(7):77-80.

HOWES, W.G.
1911 New species of Lepidoptera. *Transactions and Proceedings of the New Zealand Institute* 43:127-128. Pl 1.
1912 New species of Lepidoptera, with notes on the larvae and pupae of some New Zealand butterflies. *Transactions and Proceedings of the New Zealand Institute* 44:203-208.
1914 New Lepidoptera. *Transactions and Proceedings of the New Zealand Institute* 46:95-96.
1917 New Lepidoptera. *Transactions and Proceedings of the New Zealand Institute* 49:274.

HUDSON, G.V.
1891 On the New Zealand Cicadidae. *Transactions and Proceedings of the New Zealand Institute* 23:49-55.
1918 Description of new species of Lepidoptera from New Zealand. *Entomologists Monthly Magazine* 54:61-63.
1925 Descriptions of three new species of Lepidoptera from New Zealand. *Entomologists Monthly Magazine* 61:220-221.
1939 *A Supplement to the Butterflies and Moths of New Zealand.* Wellington, Ferguson & Osborn. Pp 387-481. Pls 53-62.

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE
1985 *International Code of Zoological Nomenclature,* Third edition. Great Britain, International Trust for Zoological Nomenclature. 338pp.

KASZAB, Z.
1985 Beiträge zur Kenntnis der pazifischen Tenebrioniden (Coleoptera). *Folia Entomologica Hungarica* 46:23-63.

KELSEY, J.M.
1943 A new termite, *Calotermes (Calotermes) curvithorax* n.sp., from Canton Island, in the Phoenix group, Pacific Ocean. *New Zealand Journal of Science and Technology* 25(B)(2):45-53.

KIRMAN, M.
1985 *Clavaptera ornata* n.gen. et sp., a new genus and species of Carventinae (Hemiptera: Heteroptera: Aradidae) from Northland, New Zealand. *New Zealand Journal of Zoology* 12:125-129.
1989 A new genus and species of Carventinae (Hexapoda: Hemiptera: Aradidae) from Northland, New Zealand. *Records of the Auckland Institute and Museum* 26:25-32.

KNIGHT, W.J.
1975 Deltocephalinae of New Zealand (Homoptera: Cicadellidae). *New Zealand Journal of Zoology* 2(2):169-208.

KORMILEV, N.A.
1971 Mezirinae of the Oriental region and South Pacific (Hemiptera - Heteroptera: Aradidae). *Pacific Insects Monograph* 26:1-165.

KURAHASHI, H.
1971 The tribe Calliphorini from Australian and Oriental regions. 2. *Calliphora*-group (Diptera: Calliphoridae). *Pacific Insects* 13(1):141-204.

LEE, C.E. and J.G. PENDERGRAST
1977 The Aradidae of New Zealand (Hemiptera: Heteroptera) IV. The Mezirinae, with a consideration of the genitalia. *New Zealand Journal of Zoology* 4:167-175.

LEE, K.E.
1959 The earthworm fauna of New Zealand. *New Zealand Department of Scientific and Industrial Research Bulletin* 130:1-486.

LUXTON, M.
1984 New species of intertidal Mesostigmata (Acari) from New Zealand. *Records of the Auckland Institute and Museum* 21(1):83-100.
1989 New taxa of intertidal mites (Acari). *Journal of Natural History* 23(2):407-428.

LYNEBORG, L.
1992 Therevidae (Insecta: Diptera). *Fauna of New Zealand* 24:1-140.

MARPLES, B.J.
1956 Spiders from the Three Kings Islands. *Records of the Auckland Institute and Museum* 4(6):329-342.

MAY, B.M.
1967 The Broun species numbers (Coleoptera). *Transactions of the Royal Society of New Zealand, Zoology* 9(13):175-180.

MILLIDGE, A.F.
1988 Linyphiidae. *In* FORSTER, R.R., MILLIDGE, A.F. and D.J. COURT. The spiders of New Zealand. Part VI. *Otago Museum Bulletin* 6:1-124.

PALMA, R.L., LOVIS, P.M. and C. TITHER
1989 An annotated list of primary types of the phyla Arthropoda (except Crustacea) and Tardigrada held in the National Museum of New Zealand. *National Museum of New Zealand Miscellaneous Series* 20:1-49.

PENDERGRAST, J.G.
1950 The genus *Rhopalimorpha* Dallas (Hemiptera - Heteroptera) with a description of a new species. *Records of the Auckland and Museum* 4(1):31-34.
1965 The Aradidae of New Zealand (Hemiptera - Heteroptera) II - The Isoderminae. *Transactions of the Royal Society of New Zealand, Zoology* 6(23):235-243.

PHILPOTT, A.
1917 Descriptions of new species of Lepidoptera. *Transactions and Proceedings of the New Zealand Institute* 49:239-245.
1918 Descriptions of new species of Lepidoptera. *Transactions and Proceedings of the New Zealand Institute* 50:125-132.
1919 New species of Lepidoptera. *Transactions and Proceedings of the New Zealand Institute* 51:224-225.
1928 Notes and descriptions of New Zealand Lepidoptera. *Transactions and Proceedings of the New Zealand Institute* 58:359-370.
1930 New species of Lepidoptera in the collection of the Auckland Museum. *Records of the Auckland Institute and Museum* 1(1):1-70.
1931 Notes and descriptions of New Zealand Lepidoptera. *Transactions and Proceedings of the New Zealand Institute* 62(1):1-66.

POWELL, A.W.B.
1941 Biological primary types in the Auckland Museum. *Records of the Auckland Institute and Museum* 2(5):239-259.
1949 Biological primary types in the Auckland Museum. No 3. Zoological (supplement). *Records of the Auckland Institute and Museum* 3(6):401-409.

PRITCHARD, E.D.
1932 Notes on a new Collembola from New Zealand. *Records of the Auckland Institute and Museum* 1(3):135-137.

RICHARDS, A.M.
1958 Revision of the Rhaphidophoridae (Orthoptera) of New Zealand. Part III. - The genera *Pachyrhamma* Brunner and *Pallidoplectron* n.g. *Transactions of the Royal Society of New Zealand* 85(4):695-706.
1959a Revision of the Rhaphidophoridae (Orthoptera) of New Zealand. Part IV - The Rhaphidophoridae of the Thames gold mines. *Transactions of the Royal Society of New Zealand* 87(1-2):27-33.
1959b Revision of the Rhaphidophoridae (Orthoptera) of New Zealand - Part VI. A new species belonging to the genus *Pachyrhamma* Brunner, 1888. *Transactions of the Royal Society of New Zealand* 87(3-4):329-332.
1962 Revision of the Rhaphidophoridae (Orthoptera) of New Zealand. Part XI - A new species belonging to the genus *Gymnoplectron* Hutton, 1897, from the Poor Knights Islands. *Transactions of the Royal Society of New Zealand, Zoology* 2(24):203-207.

ROWE, R.J.
1981 A new species of *Xanthocnemis* Tillyard (Odonata: Coenagrionidae) from the Chatham Islands, New Zealand. *Records of the Auckland Institute and Museum* 18:205-209.
1987 *The Dragonflies of New Zealand.* Auckland, Auckland University Press. 260pp.

SALMON, J.T.
1948a Collembola from the Three Kings Islands with a description of *Proisotomina,* new genus. *Records of the Auckland Institute and Museum* 3(4-5):291-300.

1948b New genera, species and records of Orthoptera from the Three Kings Islands, New Zealand. *Records of the Auckland Institute and Museum* 3(4-5):301-307. Pls 56-59.
1948c New species and records of Lepidoptera from Three Kings Islands, New Zealand. *Records of the Auckland Institute and Museum* 3(4-5):309-311. Pl 60.

SALMON, J.T. and J.D. BRADLEY
1956 Lepidoptera from the Cape Expedition and Antipodes Islands. *Records of the Dominion Museum, Wellington* 3:61-81.

SATCHELL, G.H.
1954 Keys to the described species of New Zealand Psychodidae with descriptions of eight new species. *Transactions of the Royal Entomological Society of London* 105(20):475-491.

SCHUH, R.T.
1984 Revision of Phylinae (Hemiptera, Miridae) of the Indo-Pacific. *Bulletin of the American Museum of Natural History* 177(1):1-476.

SPILLER, D.
1942 A giant weevil *Phaeophanus turbotti* n. sp. from the Poor Knights Islands. *Records of the Auckland Institute and Museum* 2(6):265-267.

TOWNSEND, J.I.
1971 Entomology of the Aucklands and other islands south of New Zealand: Coleoptera: Carabidae: Broscini. *Pacific Insects Monograph* 27:173-184.

WALKER, A.K. and T.K. CROSBY
1988 *The preparation and curation of insects.* Wellington, Science Information Publishing Centre, DSIR (DSIR Information Series 163). 92pp.

WATT, J.C.
1961 A contribution to a systematic revision of the New Zealand genus *Cilibe* Brême (Coleoptera, Tenebrionidae). Unpublished M.Sc. thesis, University of Auckland. 242pp.
1988 A revision of the genus *Mimopeus* (Tenebrionidae). *Records of the Auckland Institute and Museum* 25:95-146.
1992 Tenebrionidae (Insecta: Coleoptera): catalogue of types and keys to taxa. *Fauna of New Zealand* 26:1-69.
1993 *Menimus crosbyi,* a new name for *M. clarkei* Watt 1992 (Coleoptera: Tenebrionidae). *Records of the Auckland Institute and Museum* 30:47.

WILTON, C.L.
1968 Migidae. Pp 74-126 *In* FORSTER, R.R. and C.L. WILTON, The spiders of New Zealand. Part II. *Otago Museum Bulletin* 2:1-180.

WINTERBOURN, M.J.
1965 Studies on New Zealand stoneflies. I. Taxonomy of larvae and adults. *New Zealand Journal of Science* 8:253-284.
1970 The Hydrophilidae (Coleoptera) of New Zealand's thermal waters. *Transactions of the Royal Society of New Zealand, Biological Science* 12(4):21-28.

WISE, K.A.J.
1958 Trichoptera of New Zealand. 1. A catalogue of the Auckland Museum collection with descriptions of new genera and new species. *Records of the Auckland Institute and Museum* 5(1-2):49-63.

1972 Trichoptera of the Auckland Islands. *Records of the Auckland Institute and Museum* 9:253-267.

1982 Two new species of Trichoptera from the Murchison mountains, South Island, New Zealand. *Records of the Auckland Institute and Museum* 19:149-151.

WOMERSLEY, H.

1941 New species of *Geckobia* (Acarina, Pterygosomidae) from Australia and New Zealand. *Transactions of the Royal Society of South Australia* 65(2):323-328.

WOODWARD, T.E.

1950a New records of Miridae (Heteroptera) from New Zealand, with descriptions of a new genus and four new species. *Records of the Auckland Institute and Museum* 4(1):9-23.

1950b A new species of *Cermatulus* Dallas from the Three Kings Islands, New Zealand (Heteroptera: Pentatomidae). *Records of the Auckland Institute and Museum* 4(1):24-30.

1953a The Heteroptera of New Zealand. Part I - Introduction: Cydnidae; Pentatomidae. *Transactions of the Royal Society of New Zealand* 80(3-4):299-321. Pls 62-71.

1953b New genera and species of Rhyparochrominae from New Zealand (Heteroptera: Lygaeidae). *Records of the Canterbury Museum* 6(3):191-218.

1954 New records and descriptions of Hemiptera - Heteroptera from the Three Kings Islands. *Records of the Auckland Institute and Museum* 4(4):215-233.

1956 On Australian and New Zealand Peloridiidae (Homoptera: Coleorrhyncha). *University of Queensland Papers, Department of Entomology* 1(3):1-56.

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NATAL DOWN AND EGG SIZE OF THE KOKAKO *CALLAEAS CINEREA* (AVES: CALLAEIDAE)

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Abstract. A full-term embryonic Kokako *Callaeas cinerea* had 11 well-developed patches of natal down. These included all eight main down-patches noted on two New Zealand passerines previously studied by the author (Grey Warbler *Gerygone igata* and Whitehead *Mohoua albicilla*), plus the caudal, primary and crural patches. Twelve Kokako eggs were 34.2-42.1 mm long and 25.7-29.2 mm wide. It seems likely that South Island eggs are slightly larger on average than those from the North Island.

In December 1992, while studying the nesting of North Island Kokakos *Callaeas cinerea wilsoni* (Callaeidae) at Rotoehu Forest north of Rotorua, J.G. Innes obtained a full-term embryo that died while emerging from its egg. This embryo (now held at Auckland Museum, reg. no. B3685) has afforded me the opportunity of determining the arrangement of natal down. This is a character that may prove helpful in elucidating taxonomic relationships (Wetherbee 1957). To date among New Zealand passerines the arrangement of natal down has been described for only two other species, the Grey Warbler *Gerygone igata* (Gill 1983) and Whitehead *Mohoua albicilla* (Gill 1993).

During field work, J.G. Innes and P. Bradfield obtained some addled North Island Kokako eggs for Auckland Museum. As so little has been published on the breeding of this difficult species, I have summarised the length and breadth measurements of Kokako eggs held by Auckland Museum (AIM) and the Museum of New Zealand (MONZ) or described in the literature. There are no Kokako eggs at present in the collections of Canterbury Museum, Christchurch (G. Tunnicliffe, pers. comm.), or Otago Museum, Dunedin (J. Darby, pers. comm.).

An egg obtained in the Orongorongo Ranges near Wellington in 1875 (Table 1) was thought to belong to the Huia *Heteralocha acutirostris* (Buller 1876) but later re-identified as a Kokako egg (see Buller 1888). It contained a full-term embryo, and Buller (1876) gave the following superficial account of the natal down: "The whole of the body is bare, with the exception of what appears [*sic*] (in spirits) to be strips of coarse hair-like filaments, from one-half to three-quarters of an inch in length, and perfectly black, but are in reality tufts of extremely fine downy feathers. A strip of these filaments encircles the crown, a line passes down the course of the spine, and there is another along the outer edge of each wing and behind each thigh." The present paper confirms the general accuracy of this description.

NATAL DOWN

COLOUR

The down of embryo B3685 is dark grey, almost black, while wet, and paler grey when dry and fluffed out. Potts (1874: 147) described nestlings in a nest at Milford Sound, as

Table 1. Measurements (mm) of 12 Kokako eggs, all from the North Island except the first three.

Reg. No. or Authority	Locality	Date	Length	Breadth
Buller (1888)	Westland	c. 1874	40.6	29.2
"	"	"	41.9	27.9
MONZ 7626	Hokitika	c. 1880	42.1	27.2
Buller (1876)	Orongorongos	Oct. 1875	36.8	26.7
Oliver (1955)	Hunuas	Nov. 1887	36.0	26.5
MONZ unreg.	Mapara	Feb. 1992	37.4	26.0
MONZ unreg.	"	Feb. 1992	-	26.7
AIM B1579a	Rotoehu	Feb. 1990	38.0	27.4
AIM B3626a	"	Dec. 1991	37.0	25.7
AIM B3684a	"	Feb. 1993	34.2	26.3
AIM B3684b	"	Feb. 1993	35.3	26.9
AIM B5672	Mapara	Jan. 1993	41.4	26.7

"partially clothed with slate-coloured down". Chicks in a nest east of Auckland had "dark brown" down (McKenzie 1951).

DISTRIBUTION

The natal down feathers (neossoptiles) of passerines seem to be distal extensions of some (not all) of the teleoptiles that develop later during the nestling period (see Wetherbee 1957). The downs occur in regions or patches for the names of which I have chosen from among those used by Saunders (1956) and Wetherbee (1957).

Fig. 1 shows the eleven down patches present on the Kokako embryo. In general I have not followed Wetherbee (1957) in counting the exact number of downs and showing their orientation. The Kokako embryo is fixed in the curled foetal position, making examination difficult, and has already lost some down through abrasion.

The ocular patches, dorso-posterior to the eyelids, comprise two (on one side) and three (on the other) small downs no longer than 3 mm. The coronal and occipital patches are greatly developed, almost completely encircling the top of the head with more than 90 downs up to about 10 mm long. It is difficult to see where the coronal patches end and the occipital begins. These patches have a complicated disposition of individual downs, which in places seem to form clusters rather than simple rows.

The spinal patch runs from about the level of the posterior edge of the wing stumps to the tail base. It contains more than 50 downs up to 14 mm long. Anteriorly and posteriorly it forms a double row of downs but at about the mid-point it swells to a wider cluster of downs.

The caudal patches are conspicuously represented by four short downs (up to about 6 mm long) at each side of the tail base. These presumably correspond to the upper rectrix coverts. About 1 mm inferior to these a row of 12 very short downs (1-2 mm long) running from side

to side along the posterior edge of the tail base represents the tips of the rectrices. Inferior to these again a row of very short downs must be the undertail coverts.

Each humeral patch is a double row of nine (i.e. 2 x 9 = 18) downs that are up to about 13 mm long. The secondary and primary patches are more or less continuous. Each secondary patch has three rows of about 30 downs in total. The longest downs (up to about 9 mm) are on the two rows lying more dorsally along the surface of the wing. These are presumably upperwing coverts. The most ventral row has mostly short downs (c. 2 mm) and these probably represent the secondary remiges. Each primary patch comprises a double row of about 20 short downs no longer than about 2 mm. These seem to be the primary remiges and a row of coverts. There are three microscopic downs on the alula.

The femoral patches contain about 40 long downs (up to 10 mm long) arranged in four rows. Crural down is scattered on the forward, rear and outer side of the leg at the region corresponding with the distal end of the tibiotarsus. There are about 35 downs on each leg, up to 10 mm long.

The abdominal patches are postero-ventral to the point of insertion of the legs. Each comprises one row of about 10 short downs up to about 4 mm long.

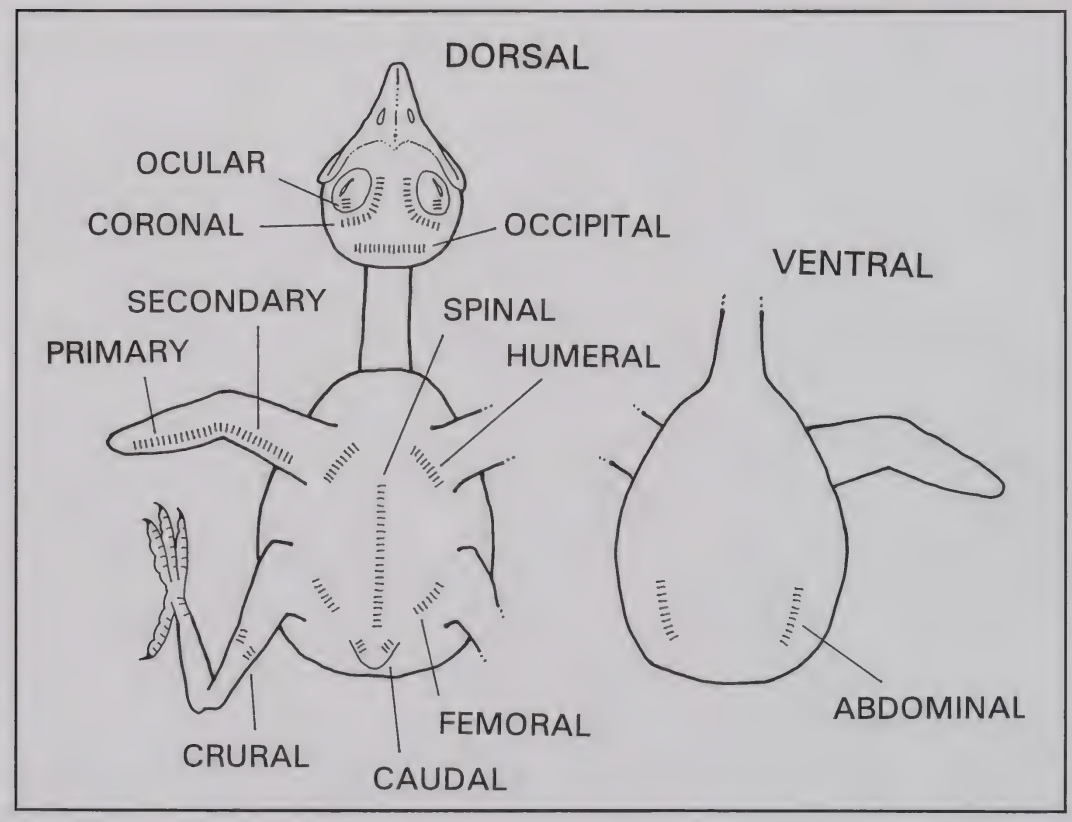

Fig. 1. Down patches of the Kokako *Callaeas cinerea* shown schematically. This diagram does not show the number or precise arrangement of the downs.

EGGS

South Island Kokako (Callaeas cinerea cinerea)

Potts (1874: 147) gave the measurements of two eggs from a nest found near the Paringa River, Westland, as 1 inch 7 lines (40.2 mm) x 1 inch 1 line (27.5 mm). I take this to be an approximation for the size of both eggs. These are apparently the same two eggs that according to Buller (1888: 6) were presented by Potts to Canterbury Museum and were measured by Buller: his measurements were 1.60 inches (40.6 mm) x 1.15 inches (29.2 mm) and 1.65 inches (41.9 mm) x 1.10 inches (27.9 mm). My measurements of an egg in the Museum of New Zealand (MONZ 7626) from Hokitika, Westland, are given in Table 1. This is presumably the egg from Ko-i-te-rangi (Kowhitirangi) Hill on the Hokitika River, presented to the Colonial Museum by Campbell (1880). South Island eggs are therefore 40.6-42.1 mm long by 27.2-29.2 mm wide.

North Island Kokako (Callaeas cinerea wilsoni)

Measurements of nine North Island eggs are given in Table 1, all measured by me except for the two reported by Buller (1876) and Oliver (1955). North Island eggs are 34.2-41.4 mm long by 25.7-27.4 mm wide. The average length is 37.01 mm (s.d. = 2.148, n = 8). The average width is 26.54 mm (s.d. = 0.500, n = 9). Eggs from the North Island appear to be slightly smaller than those from the South Island, but more data from the latter are needed to confirm this. Embryo B3685 and its yolk sack has a wet weight (drained of surplus preserving fluid) of 6.7 g. Kokako eggs are likely to weigh at least this much.

DISCUSSION

All 11 down patches of the Kokako are well developed, comprising numerous, relatively long, darkly coloured downs. The least developed is the ocular. In both the Grey Warbler and Whitehead there are only eight sizable and consistently present patches (Gill 1983, 1993), the same eight in both cases. All these occur in the Kokako with the addition of the caudal and primary patches (lacking in the other two species) and the crural patch. The crural is strongly developed in the Kokako but absent in most Grey Warblers, minute where it does occur, and weakly developed in the two Whiteheads examined.

The natal down of more New Zealand passerines must be studied before any useful interspecific comparisons can be made. That the three species discussed above show both similarities and differences gives hope that natal down may be a helpful taxonomic character in New Zealand. The most interesting comparisons may be between New Zealand and Australian birds. The natal down of Whiteheads ought to be closer to that of *Pachycephala* than to *Malurus*, if Whiteheads are indeed in the Pachycephalidae rather than the Maluridae. A comparison between the natal down of *Callaeas* and *Aplonis* may help to determine how close the Callaeidae is to the Sturnidae.

The larger size of South Island eggs, if real, would be consistent with Bergmann's Rule which states that among the forms of a polytypic species body-size tends to be larger in cooler parts of the range (Campbell & Lack 1985). The bill is longer in the South Island race (Oliver 1955), but other body dimensions are similar.

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REFERENCES

BULLER, W.L.
1876 On the nesting habits of the Huia (*Heteralocha acutirostris*). *Trans. NZ Inst.* 8:192-193.
1888 *A History of the Birds of New Zealand.* Vol. 1. 2nd ed. Privately published, London.

CAMPBELL, B. and E. LACK (eds)
1985 *A Dictionary of Birds.* Poyser, England.

CAMPBELL, W.D.
1880 Notes on the nesting habits of the Orange-wattled Crow. *Trans. NZ Inst.* 12:249-250.

GILL, B.J.
1983 Breeding habits of the Grey Warbler (*Gerygone igata*). *Notornis* 30:137-165.
1993 Notes on the nesting and longevity of Whiteheads. *Notornis* 40:141-143.

McKENZIE, H.R.
1951 Breeding of Kokako. *Notornis* 4:70-76.

OLIVER, W.R.B.
1955 *New Zealand Birds.* Reed, Wellington.

POTTS, T.H.
1874 On the birds of New Zealand. Part 4. *Trans. N.Z. Inst.* 6:139-153.

SAUNDERS, A.A.
1956 Descriptions of newly-hatched passerine birds. *Bird-Banding* 27:121-128.

WETHERBEE, D.K.
1957 Natal plumages and downy pteryloses of passerine birds of North America. *Bull. Amer. Mus. Nat. Hist.* 113:339-436.

B.J. GILL, Auckland Institute and Museum, Private Bag 92018, Auckland.

SPECIES OF *MICROMUS* (NEUROPTERA: HEMEROBIIDAE) IN NEW ZEALAND

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Abstract. The endemic New Zealand species *Micromus bifasciatus* Tillyard, 1923 is compared with *Micromus tasmaniae* (Walker, 1860) a species common in both Australia and New Zealand. Three syntypes from Tasmania, Australia, are designated as lectotype and paralectotypes of *Hemerobius tasmaniae* Walker, 1860. Redescriptions of specimens known as 'varieties' suggest they could be hybrids of the two species.

Of the five species of Hemerobiidae recorded in New Zealand (Wise 1991), the only endemic is *Micromus bifasciatus* Tillyard, 1923 (Fig. 1). This species is examined and compared with *Micromus tasmaniae* (Walker, 1860) (Fig. 2) which is the common lacewing in both Australia and New Zealand. Named varieties of the former are considered as variations only but those of the latter are described and discussed separately.

Tillyard (1923) described *Micromus bifasciatus* from southern South Island specimens first collected in 1905, with two varieties *amabilis* and *imperfectus*, from North I specimens. Hudson (1950) recorded the species *M. bifasciatus* and suggested that Tillyard's var. *amabilis*, with pink-veined wings, is the normal form. Hudson's colour figure is of this form but it somewhat over-emphasizes the pink coloration in the wings. He also noted that he took the first known specimen in 1904. *Micromus bifasciatus* has been progressively recorded by Wise (1963, 1973, 1977, 1983, 1988, 1991) while Monserrat (1990b) listed the species and the two varieties. Wise (1991) extended the distribution of the species to Stewart I.

The widespread *Micromus tasmaniae* (Walker, 1860) has been recorded in New Zealand, first by McLachlan (1869) and many times since. Broun (1898) recorded *Chrysopa* as being common but that genus (and the Family Chrysopidae) was not then known in this country and the reference is probably to this species. Alfken (1904) recorded *M. tasmaniae* on Chatham Is, and it was recorded by Wise (1971) on Auckland Is and Antipodes Is, Wise (1972) on Kermadec Is, Roberts (1979) on Cavalli Is and Wise (1983, 1985) on Poor Knights Is and other off-shore islands.

Tillyard (1923) gave a brief description of the wings of *M. tasmaniae* and described two varieties, *manapouriensis* and *nigroscriptus*. Previously, the wings of this species had been described by Tillyard (1916) as being variable in colour and, later, the species was re-described by New (1988), but there is no mention by either author of colour varieties appearing amongst Australian specimens. Hudson (1950) discussed the species and gave a colour figure which can be compared with his figure of *M. bifasciatus*. *Micromus tasmaniae* has been listed for New Zealand by McLachlan (1869, 1873, 1874), Hutton (1874, 1899, 1904), Hudson (1904), and Wise (1963, 1973, 1977, 1991). Monserrat (1990a) mentioned the species and also listed it (1990b) together with the two Tillyard varieties.

Fig. 1. *Micromus bifasciatus* Tillyard, 1923. Female. (Photo: K. Pfeiffer).

Fig. 2. *Micromus tasmaniae* (Walker, 1860). Female. (Appearance of dark median lines in cells is an artefact). (Photo: K. Pfeiffer).

In the synonymic lists for each species below, references for the New Zealand sub-region are given; the three main islands and close off-shore islands are indicated as "NZ", the outlying island groups are named. In the Australian sub-region, the southern island of Tasmania was first named "Van Diemens Land" and continental Australia was first named "New Holland", which names both appear in early insect records. After the first reference to each, below, Tasmania is included with other Australian records as "Aust". Records beyond Australasia are not included here as they have already been listed (Wise 1991).

Specimens are in the collections of Auckland Institute and Museum (AMNZ); The Natural History Museum, previously British Museum (Natural History), London, England (BMNH); Canterbury Museum, Christchurch (CMNZ); Lincoln University, previously Lincoln College, Entomology Department, Canterbury (LCNZ); Museum of New Zealand, previously National Museum of New Zealand, Wellington (NMNZ); and Landcare Research, Auckland (NZAC).

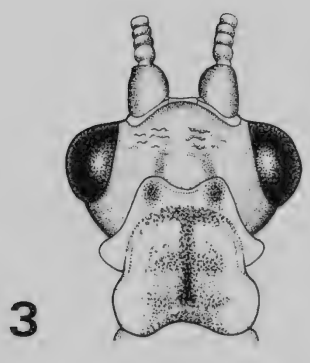
G.V Hudson labels are tiny number/letter labels and the specimen data given in brackets is from the G.V. Hudson collection register in NMNZ; data from other labels (where present) follows. Records of missing Hudson specimens are included in case they can now be recognised in other collections.

Genus **Micromus** Rambur, 1842

Micromus Rambur, 1842, Histoire naturelle insectes Névroptères, 416.
Nesomicromus Perkins, 1899, Fauna Hawaiiensis Ed.2(2): 37.
Eumicromus Nakahara, 1915, Annotat. Zool. Japon 9: 36.
Austromicromus Nakahara, 1960, Mushi 34: 35.
Micromus Tjeder, 1961, South African Animal Life 8: 305.

Micromus bifasciatus Tillyard, 1923 (Figs. 1, 3, 5, 7-17, 29)

Micromus bifasciatus Tillyard, 1923, Trans. N.Z. Inst. 54: 221 (NZ).
Micromus bifasciatus var. *amabilis* Tillyard, 1923, Trans. N.Z. Inst. 54: 222 (NZ).
Micromus bifasciatus var. *imperfectus* Tillyard, 1923, Trans. N.Z. Inst. 54: 223 (NZ).
Micromus bifasciatus : Hudson, 1950, Fragments N.Z. Ent., 117(NZ).
Micromus bifasciatus var. *amabilis* : Hudson, 1950, Fragments N.Z. Ent., 117 (NZ).
Micromus bifasciatus : Wise, 1963, Pacific Insects 5(1): 55 (NZ).
Micromus bifasciatus : Wise, 1973, N.Z. Ent. 5(2): 184 (NZ).
Micromus bifasciatus : Wise, 1977, Bull. Auckland Inst. Mus. 11:132 (NZ).
Micromus bifasciatus : Wise, 1983, Rec. Auckland Inst. Mus. 20: 255 (NZ).
Micromus bifasciatus : Wise, 1988, Rec. Auckland Inst. Mus. 25: 183 (NZ).
Micromus bifasciatus : Monserrat, 1990, *In* Advances in Neuropterology, 227 (NZ).
Micromus bifasciatus var. *amabilis* : Monserrat, 1990, *In* Advances in Neuropterology, 227 (NZ).
Micromus bifasciatus var. *imperfectus* : Monserrat, 1990, *In* Advances in Neuropterology, 227 (NZ).
Micromus bifasciatus : Wise, 1991, Rec. Auckland Inst. Mus. 28: 212, 214 (NZ).



Figs. 3, 4. *Micromus* spp. Head and prothorax, dorsal. 3. *M. bifasciatus*. 4. *M. tasmaniae*. (Del. P. Quinn).

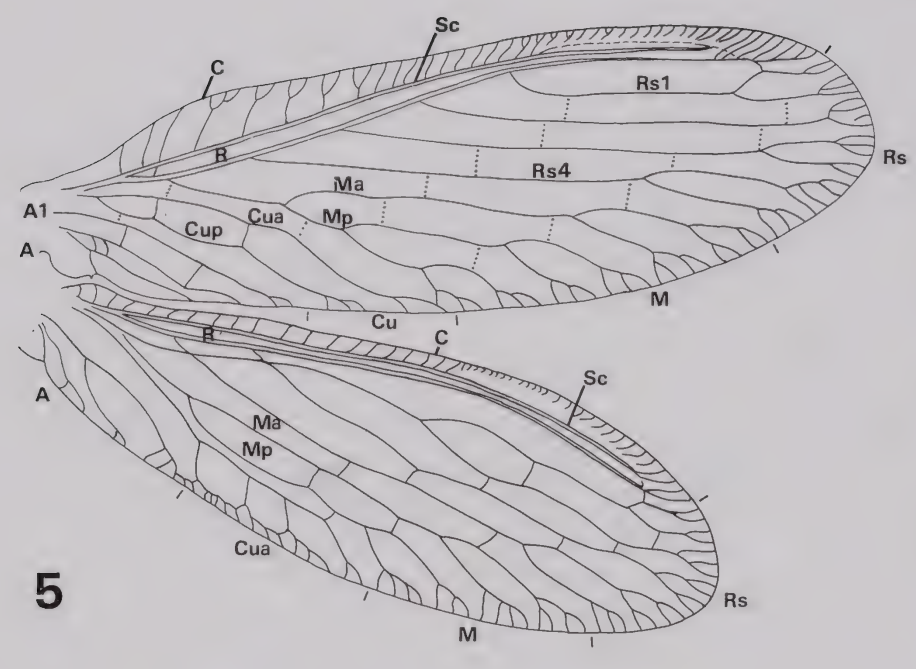
Small, brown species, some specimens very dark, almost black. Wings mainly clear, main veins often pink; anterior wings with two dark brown transverse bands, an obvious dark brown elongate streak between two close veins towards base, various light to dark patches around wing margin; posterior wings with some dark veins and cross-veins in apical and posterior areas.

Antennae. Almost unicolorous, light brown, sometimes slightly darker towards apex; scape large, basal flagellar segment larger than remainder. Males, scape plus 58-64 flagellar segments; females, scape plus 58(54,56?)-66(67?) flagellar segments.

Head. Face (including labrum) pale, sometimes darker towards antennae, sometimes with darker or cream-coloured patch below each antenna. Dorsum (Fig. 3) extending anteriorly between antennae, setose; posteriorly tubercles arranged in short lines giving transversely corrugated appearance, pale brown with central pair of darker brown longitudinal stripes sometimes extending laterally. Head laterally pale brown with darker brown patch behind and below eye.

Prothorax (Fig.3) sparsely setose; laterally pale brown to cream, dorsally with wide median dark brown stripe darkest on median line. Legs setose, light brown, apical tarsal segment darker. Prothoracic tibiae tapering apex to base, mesothoracic swollen in apical third, metathoracic swollen in apical two-thirds.

Wings (Fig. 1). Elongate, tapering to rounded ends apically. Forewing lightly setose, thickest in pterostigma. Veins more or less tinged pink, sometimes light brown, with brown markings. Main veins sometimes with occasional dark dashes; gradate cross-veins in two series, brown . Membrane mainly clear, brown in patches on posterior side of radius, around cross-veins in two gradate series forming two obvious transverse bands, between two close



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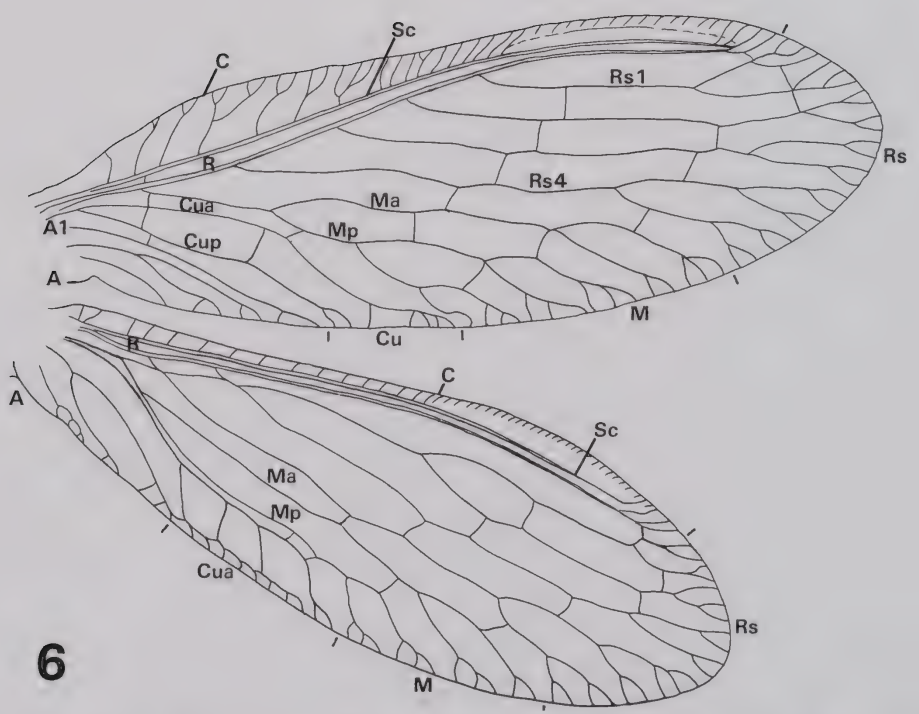

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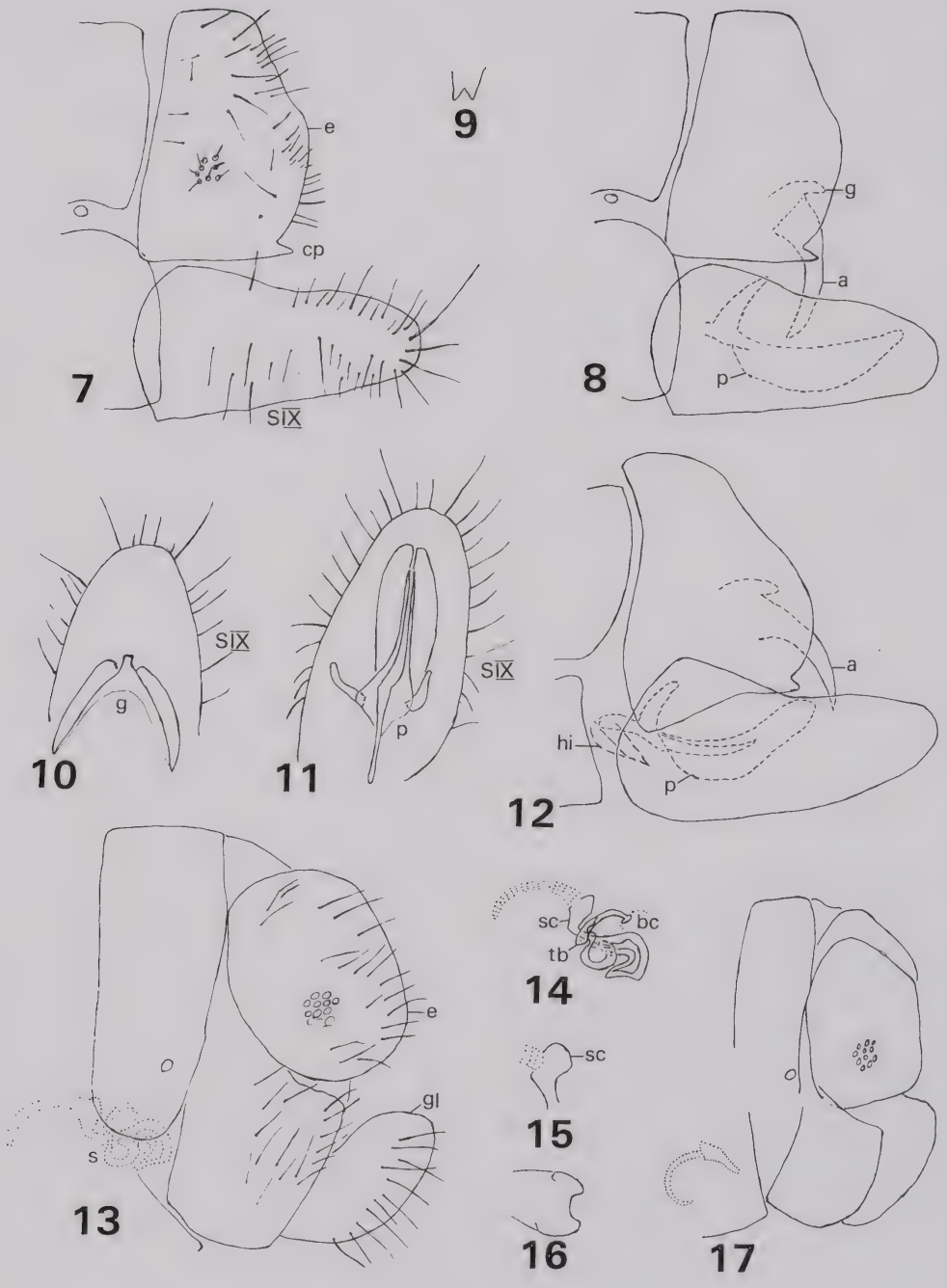
Figs. 5, 6. *Micromus* spp. Wing venation. ♀♀. 5. *M. bifasciatus*. 6. *M. tasmaniae*. (For abbreviations see description).



Figs. 7-17. *Micromus bifasciatus*. Genitalia . ♂. 7. Lateral. 8. Parameres *in situ*. Lateral. 9. Apex of arcessus. 10. Gonarcus and outline of Sternite IX. Dorsal. 11. Parameres and outline of Sternite IX. Ventral. 12. Another specimen. Lateral internal. Genitalia. ♀. 13. Lateral. 14. Spermatheca. 15. Spermatheca, subapical chamber. Another view. 16. Subgenitale. Ventral. 17. Another specimen. Dorso-lateral. (For abbreviations see description).

medial and cubital veins towards base extending most or entire length of cell forming an obvious streak, sometimes in well-spaced patches around wing margin, sometimes with length of shading along apical-posterior margins. Hindwing main veins sometimes pink, otherwise veins pale brown to colourless, sometimes parts of veins darker in apical-posterior areas, apical cross-veins darker. Membrane clear, sometimes tinged brown around apical cross-veins.

Wing venation (Fig. 5). Forewing with Costa (C) slightly bowed in basal half, costal area broadest at less than 1/4 of wing, humeral vein simple; some forked veinlets before pterostigma; pterostigma thickened, elongate along Subcosta (Sc), not touching Costa, smaller than in hindwing. One basal cross-vein Sc to Radius (R). Sc not fused with R. Sc with few forked veinlets at margin, remainder of veins with forked veinlets at margin. Radial sectors (Rs) and Medius (M) arise separately from R. One apical cross-vein R-Rs. Usually four Rs, rarely 3 or 5; cross-veins present in two gradate series Rs1- Medius anterior (Ma). Base of M present, forked with 2 cross-veins in fork; Medius posterior (Mp) forked with 1 cross-vein in fork. Two short cross-veins M, Mp- Cubitus anterior (Cua). Cubitus (Cu) forked near base with 2 cross-veins in fork, 1 cross-vein Cubitus posterior (Cup) to Anal 1 (A1). Three Anal veins (A1, A2, A3), with cross-veins.

Hindwing with costal area narrow, many simple veinlets. Pterostigma stronger than forewing, extending from Sc to C, with possibly a few forked veinlets apically. No basal cross-vein Sc-R. R forked at apex, remainder of veins with forked veinlets at margin. Rs arising basally with 4 branches, 2 basal cross-veins R-Rs (or 1 stem, 1 cross-vein), 1 apical cross-vein R-Rs. Cross-veins in two gradate series Rs1-Ma. M forked with 2 cross-veins in fork, 1 apical cross-vein Mp-Cua. Cua arises separately, 2 or 3 A present.

Abdomen. Brown, darker dorsally.

Genitalia (Figs. 7-17). ♂. Ectoproct (e) rounded apically, with short catoprocessus (cp) ventrally. Sternite IX (S IX) elongate, slipper-shaped (see *M. tasmaniae*); deeper at base, almost triangular in lateral view; rounded sides tapering slightly to rounded apex in dorsal/ventral views. Gonarcus (g) extended dorsally over base of arcessus (a); arcessus large, curved, sometimes with tip bifurcate. Parameres (p) fused at base (anteriorly), with a long slender dorsal process (lateral view); a pair of lateral processes; a pair of thin posterior processes extending into paired, upcurved, posterior membranous lobes. Hypandrium internum (hi) small.

♀. Ectoproct rounded posteriorly, gonapophyses laterales (gl) elongate. Spermatheca (s) internally (anteriorly) with apical curved sac, lightly chitinised with series of black points on surface, followed by a more chitinised chamber, (sub-apical chamber, sc) squared in outline; duct continuing slightly curved, then strongly curved to a recurved (u-shaped) bend followed by convolutions ending in a curved entry to bursa copulatrix (bc); a tapering body (tb) present on outside before straight ending to duct. Apex of subgenitale (sg) concave centrally in ventral view.

Wing lengths. Anterior: ♂♂ 6.25-7.25 mm, ♀♀ 5.75-7.5 mm. Posterior: ♂♂ 5.5-6.5 mm, ♀♀ 5.25-6.75 mm.

Specimens. Holotype. ?. West Plains, 29.9.05 [original label]. Micromus bifasciatus Till. Type ♀ R.J.T. [abdomen missing] (Tillyard 1923 - West Plains, near Invercargill, 29th September, 1905, A. Philpott, female). (NZAC).
Allotype. ♀. Tisbury, 1. 3. 20 [original label]. Micromus bifasciatus Till. Type ♂ R.J.T. (Tillyard 1923 - Tisbury, near Invercargill, 1st March, 1920, A. Philpott, male). (NZAC).
Paratype. ?. West Plains, 29.9.05 [original label]. Brit. Mus. 1939-45 [abdomen missing] (Tillyard 1923 - near Invercargill, A. Philpott, male). (BMNH).

Var. amabilis. On rimu, Silverstream, 10.10.20 [original label]. Micromus bifasciatus Till. var. amabilis Till. (Tillyard 1923 - on rimu, Silverstream, near Wellington, H. Hamilton, male). ♂ (NZAC).
Var. imperfectus. Gisborne, N.Z. [original label]. Micromus bifasciatus Till. var. imperfectus Till. (Tillyard 1923 - Gisborne). ♀ (NZAC).

79a (G.V. Hudson. Kaitoke, amongst young matai, Dec. 27-04). ["a" deleted].
Kaitoke, 27. XII. 1904, G.V. Hudson. Micromus bifasciatus Till. var. amabilis Det. R.J. Tillyard. ♀ (AMNZ).
79b (G.V.H. Gollans Valley, Oct. 24 1919, beaten from shrubs). 1 (NMNZ).
79c (G.V.H. Beaten out of rimu tree far edge of Makara Bush, Dec. 5 1922).
Makara Bush, 5.XII.22, G.V. Hudson. B.M. 1933-274. 1 (BMNH).
79d (G.V.H. Ditto [Beaten out of rimu tree far edge of Makara Bush], May 30 1923).
Wellington,G.V. Hudson. ♀ (NMNZ).
79e (G.V.H. Ditto May 30 1923). Wellington Makara Bush, G.V. Hudson. Brit. Mus. 1931-328. 1 (BMNH).
79f (G.V.H. Ditto May 30 1923). Wellington Makara Bush, G.V. Hudson. Brit. Mus. 1931-328. 1 (BMNH).
79g (G.V.H. Ditto May 30 1923). Wellington Makara Bush, G.V.Hudson. Brit. Mus. 1931-328. ♀ (BMNH).
79h (G.V.H. Ditto Aug. 8 1923). Wellington Makara Bush, G.V. Hudson. Brit. Mus. 1931-328. ♂ (BMNH).
79k (G.V.H. Ditto Aug. 8 1923). [Missing].
79l (G.V.H. Ditto Aug. 8 1923). Wellington Makara Bush, G.V. Hudson. Brit. Mus. 1931-328. ♂ (BMNH).
79m (G.V.H. Ditto Nov. 18 1923). [Missing].
79n (G.V.H. Ditto Apl. 17 1924). 1 (NMNZ).
79n (G.V.H. Ditto Apl. 17 1924). Makara Bush, 17.IV.1924, G.V. Hudson. B.M. 1933-274. ♂ (BMNH).
79p (G.V.H. Ditto May 7 1925). [Missing].
79q (G.V.H. Ditto May 7 1925). 1 (NMNZ).
79r (G.V.H. Ditto Oct. 29 1925). Wellington Makara Bush, G.V. Hudson. Brit. Mus. 1931-328. ♀ (BMNH).
79s (G.V.H. Ditto Dec. 5 1925). [Missing].
79t (G.V.H. Ditto Dec. 5 1925). 1 (NMNZ).
79u (G.V.H. Ditto Dec. 5 1925). [Missing].
79v (G.V.H. Ditto Nov. 17 1926). Wellington Makara Bush, G.V.Hudson. Brit. Mus. 1931-328. ♂ (BMNH).
79x (G.V. H. Ditto Feb. 24 1927). [Missing].
79y (G.V.H. Ditto Aug. 29 1927). [Missing].

79z (G.V.H. [Ditto] Feb. 25 1928). 2 (NMNZ).
79α (G.V.H. Ditto July 28 1928). ["α" deleted]. [Missing].
79β (G.V.H. Ditto Nov. 24 1928). [Missing].
79γ (G.V.H. Makara Bush, Aug. 3 1929). Makara Bush, 3.VIII.1929, G.V. Hudson. B.M. 1933-274. ♀ (BMNH).
79δ (G.V.H. Ditto [Makara Bush] Jan. 16 1930). Makara Bush,16.I.1930, G.V. Hudson. B.M. 1932-218. ♀ (BMNH).
Makara Bush, 16.I.1930, G.V. Hudson. B.M. 1932-218. ♂ (BMNH).
79ε (G.V.H. Ditto Apl. 17 1930). 1 (NMNZ).
79α (G.V.H. Ditto Feb. 19 1934). Makara Bush, beaten from rimu, G.V. Hudson. B.M. 1935-176. 2♂♂, 1♀ (BMNH).
79 . Makara Bush, 25.I.1936. G.V. Hudson, B.M. 1936-724. ♂,♀ (BMNH).
79ζ (G.V.H. Wiltons Bush, Feb. 17 1937). 1 (NMNZ).
79 Gollans Valley, 20.XII.1937, G.V. Hudson. Brit. Mus. 1938-203. ♂,♀ (BMNH).
79E (G.V.H. Gollans Valley, Jan. 12 1942). ["E" deleted]. [Missing].
79θ (G.V.H. Beaten out of small native pine Wiltons Bush, Oct. 7 1943. 2). 2 (NMNZ).
79λ (G.V.H. Wilton's Bush, Oct. 24 - Dec. 31 1946). 8 (NMNZ).

N. Hokianga. W. of Motuti R. mouth. Swept manuka in alluvial Kahikatea forest, 10.X.1985, R.F. Gilbert. Northland "At risk" areas survey. ♂ (AMNZ).
Titirangi, 2.9.16 [original label]. Titirangi, 2.IX.1916, A.E. Brookes, 1919-201. M. bifasciatus Till. v. amabilis Till. det. D.E.K. ♀ (BMNH).
Huia, beaten *Podocarpus dacrydioides*, 4.X.1973, B.M. May. ♀ (NZAC).
Swept ex kahikatea, Karamatua Vy., Huia, 15.IV.1982, K.A.J.Wise. ♀ (AMNZ).
Naike, 7.III.1989, M. & P. Burnell. ♀ (AMNZ).
Naike, house lights, 15.I.1990, M. Burnell. ♀ (AMNZ).
Owaka, 15.1.1959, J.I. Townsend. 1 (NZAC).
Pureora, Waipapa Res. 570 m, Malaise trap in Podocarps, 23.II.1984, J. Hutcheson. ♀ (NZAC).
Lake Waikaremoana, 12.XII.1946, R. Forster. ♂ (NMNZ).
Ohakune, V-VII.1923, T.R. Harris B.M. 1923-419. Micromus bifasciatus Till. det. D.E. Kimmins. ♂ (BMNH).
On rimu, Silverstream, 10.X.1920 [original label 10.10.20]. ♀ (NZAC).
Aorere Vy., 7.X.1964, E.S. Gourlay. ♀ (NZAC).
Kenepuru Snd., foot Mt. Stokes, general beating, 10.X.1967, J.I. Townsend. ♀ (NZAC).
Pelorus B. [Pelorus Snd.] 28.XI.1928, A. Philpott. ♀ (NZAC).
Paroa nr Greymouth, 10 m a.s.l.,20-28.II.1990, B.M. Lyford. ♂ (AMNZ).
Lake Moana, 16-21.XII.1925, A. Tonnoir. 1 (CMNZ).
Christchurch [area], -.VIII.1919, Campbell. ♂, 1. (NMNZ).
Kaituna [Kaituna Lagoon],10.II.1971, Ento Dept. Field Trip. ♀ (LCNZ).
Lower Hollyford Vy., Hidden Falls Tr., general beating, 14.XII.1966, A. Walker. ♂ (NZAC).
Waenga Bush, beating at night, 16.IX.1992, G. Hall. ♂ (NZAC).
Waitati, 21.XI.1926, C.E. Clark. ♂ (AMNZ).
Stewart I. Sawdust Bay Stm., N. end, 5 m, 16.I.1993, J.B. Ward, T.R. Hitchings. ♂,♀ (AMNZ).
Stewart I. Rakeahua Vy., beating, 12.II.1968, G. Kuschel, Stewart I Exp. Feb 1968. ♂, ♀ (NZAC).
Stewart I. Rakeahua Vy., Litter 68/49, -.II.1968, G. Kuschel, Stewart I Exp. Feb. 1968. ♂, ♀ (NZAC).

Stewart I. Port Pegasus, Twilight Bay, 22.II.1968, G. Kuschel, Stewart I Exp. Feb. 1968. ♀ (NZAC).
Stewart I. Port Pegasus, Twilight Bay, Litter 68/59, 22.II.1968, G. Kuschel. ♀ (NZAC).
Stewart I. Port Pegasus, Twilight Bay, Moss 68/62, 22.II.1968, G. Kuschel. ♂ (NZAC).
Stewart I. Pegasus Ck., Litter 68/66, 24.II.1970 [error for 1968], G. Kuschel. ♀ (NZAC).
Stewart I. Pegasus, 21-25.II.1968, G. Kuschel, Stewart I Exp. Feb. 1968. ♂ (NZAC).
Stewart I. Port Pegasus, Rosa I, 29.II.1972, L.C. Hudson. ♂ (NMNZ).
[No data]. ♂ (AMNZ).

The above records are listed in order of types and original specimens, then G.V.Hudson specimens and the remainder geographically from north to south.

Varieties of *M. bifasciatus* described by Tillyard (1923) are within a range of variation for the species and not valid entities, so they are included in the description and list above.

Type specimens. The allotype specimen, labelled and recorded by Tillyard (1923) as a male, is a female. This error throws doubt on the sex given by Tillyard for the other two types, both of which are now without abdomens. Tillyard recorded only three type specimens, all from near Invercargill, so the specimen found in the BMNH collection is the paratype, although previously not so labelled; it has an original label with printed locality and handwritten date, as does the holotype specimen.

Type localities (Fig. 29). New Zealand: South Island. The three specimens recorded as types by Tillyard (1923) were taken near Invercargill, the holotype and paratype from West Plains and the allotype from Tisbury.

Distribution (Fig. 29). As previously recorded (Wise 1991), this endemic species occurs from the far north to Stewart I. The first records by Tillyard (1923) were of specimens from the south of the South I, together with two others from the North I. There are several collecting localities in the Wellington area, at the south end of the North I, due mainly to the collecting of G.V. Hudson, between 1904 and 1946. Although several specimens have been found in the north of the North I in more recent years, a specimen taken near Auckland in 1916 probably indicates that the species has long been established there.

Most of Stewart I is still isolated and wild and there is only one settlement, at Halfmoon Bay. Specimens have been taken during a few collecting expeditions in 1968, 1972 and 1993, in areas of endemic forest.

Life history. There is little information available for this species. G. V. Hudson collected *M. bifasciatus* from matai at Kaitoke, near Wellington, in December 1904 and from rimu at Makara Bush, west of Wellington, in all months of the year except March, June and September, between 1922 and 1934, which indicates an established population in which adults appear almost all year. Specimens in other collections have been taken in all months except May, June and July, so June (early winter) is the only non-recorded month.

Micromus bifasciatus has been mostly recorded from native forest, or forest remnants, and in particular from endemic matai (black pine, *Prumnopitys taxifolia*), rimu (red pine, *Dacrydium cupressinum*), kahikatea (white pine, *Dacrycarpus dacrydioides*) and "native

pine". Of the three named podocarp trees, rimu has its own host specific species of scale insect while kahikatea has an endemic scale insect which also occurs on an endemic *Podocarpus* species (Spiller & Wise 1982). Morales (1991) has recorded another species on matai, kahikatea and a *Podocarpus*. Mealy-bug species are also present on all these podocarps (Cox 1987). Various Coccoidea could constitute the food supply for this predatory neuropteran, particularly as there are few species of endemic Aphidoidea in New Zealand and none on podocarps.

Hudson noted in his register in 1923 and recorded later (1950) that when resting with closed wings this insect exactly resembles a small dried fragment of rimu foliage. He recorded also that it is never common but occurs sparingly amongst rimu foliage, or the foliage of other native podocarps.

White (unpigmented) adults of this species have been taken from samples of leaf litter which suggests that larvae pupate in that situation.

Micromus tasmaniae (Walker, 1860) (Figs. 2, 4, 6, 18-28, 29)

Hemerobius tasmaniae Walker, 1860, Trans. Ent. Soc. London (N.S.) 5 (5): 186 (Tasmania).
[*Micromus tasmaniae*]: McLachlan, 1869, Ent. Mon. Mag. 6: 27 (New Holland, New Zealand).
Micromus tasmaniae : McLachlan, 1873, Ann. Mag. Nat. Hist. (4)12 (67):39 (Australia, NZ).
Micromus tasmaniae : Hutton, 1874, Trans. Proc. N.Z. Inst. 6: 168 (NZ).
Micromus tasmaniae : McLachlan, 1874, Trans. Proc. N.Z. Inst. 6: App. xcvii (Aust, NZ) [Repr. of McLachlan, 1873].
Micromus tasmaniae : Hagen, 1886, Proc. Boston Soc. Nat. Hist. 23: 291 (Aust, NZ).
Chrysopa : Broun, 1898, Rep. Dep. Agric. N.Z. 1898: 217 (NZ) [Prob. this species].
Micromus tasmaniae : Hutton, 1899, Trans. Proc. N.Z. Inst. 31: 233 (Aust, NZ).
Micromus tasmaniae : Alfken, 1904, Zool. Jb. 19: 601 (Aust, NZ, Chatham Is).
Micromus tasmaniae : Hutton, 1904, Index Faunae Novae Zealandiae, 230 (NZ).
Micromus tasmaniae : Hudson, 1904, New Zealand Neuroptera, 57 (Aust, NZ).
Micromus tasmaniae : Tillyard, 1923, Trans. N.Z. Inst. 54: 223 (Aust, NZ).
Micromus tasmaniae var. *manapouriensis* Tillyard, 1923, Trans. N.Z. Inst. 54: 223 (NZ).
Micromus tasmaniae var. *nigroscriptus* Tillyard, 1923, Trans. N.Z. Inst. 54: 223 (NZ).
Micromus tasmaniae : Tillyard, 1926, Insects of Australia and New Zealand, 318. (Aust, NZ).
Eumicromus tasmaniae : Kimmins, 1941, Ent. Mon. Mag. 77: 135 (Aust, NZ).
Micromus tasmaniae : Hudson, 1950, Fragments New Zealand Entomology, 117 (NZ).
Nesomicromus tasmaniae : Kimmins, 1958, Bull. Brit. Mus. (Nat. Hist.) Ent. 6 (9): 242 (Aust, NZ).
Austromicromus tasmaniae : Nakahara, 1960, Mushi 34 (1): 35 (Aust, NZ).
Micromus tasmaniae : Wise, 1963, Pacific Ins. 5 (1): 55 (Aust, NZ, Chatham Is).
Micromus tasmaniae : Wise, 1971, Pacific Ins. Monogr. 27: 53 (NZ, Chatham Is, Auckland Is, Antipodes Is).
Micromus tasmaniae : Wise, 1972, Rec. Auckland Inst. Mus. 9: 270 (Aust, NZ, Kermadec Is).
Micromus tasmaniae : Wise, 1973, N.Z. Ent. 5 (2): 184 (Aust, Kermadec Is, NZ, Chatham Is, Antipodes Is, Auckland Is).
Micromus tasmaniae : Wise, 1977, Bull. Auckland Inst. Mus. 11: 132 (Kermadec Is, NZ, Chatham Is, Antipodes Is, Auckland Is).

Micromus tasmaniae : New, 1988, Invertebr. Taxon. 2: 366 (Aust).
Micromus tasmaniae : Monserrat, 1990, *In* Advances in Neuropterology, 77 (Aust, NZ).
Micromus tasmaniae : Monserrat, 1990, *In* Advances in Neuropterology, 230 (Aust).
Micromus tasmaniae var. *manapouriensis* : Monserrat, 1990, *In* Advances in Neuropterology, 230 (NZ).
Micromus tasmaniae var. *nigroscriptus* : Monserrat, 1990, *In* Advances in Neuropterology, 230 (NZ).
Micromus tasmaniae : Wise, 1991, Rec. Auckland Inst. Mus. 28: 212, 214 (Aust, Kermadec Is, NZ, Chatham Is, Antipodes Is, Auckland Is).

Small, brown species. Wings clear, except for slight darkening around some cross-veins; anterior wings liberally spotted with dark brown on veins, with two dark transverse thin lines one near midway one sub-apical, and an obvious dark spot between two close veins towards base; posterior wings with some dark spots around margin, some dark veins and cross-veins in apical and posterior areas. Membrane of most cells of forewings waved; appearance of median bar in each cell (see Fig. 2) caused by a median trough, not a pigment difference.

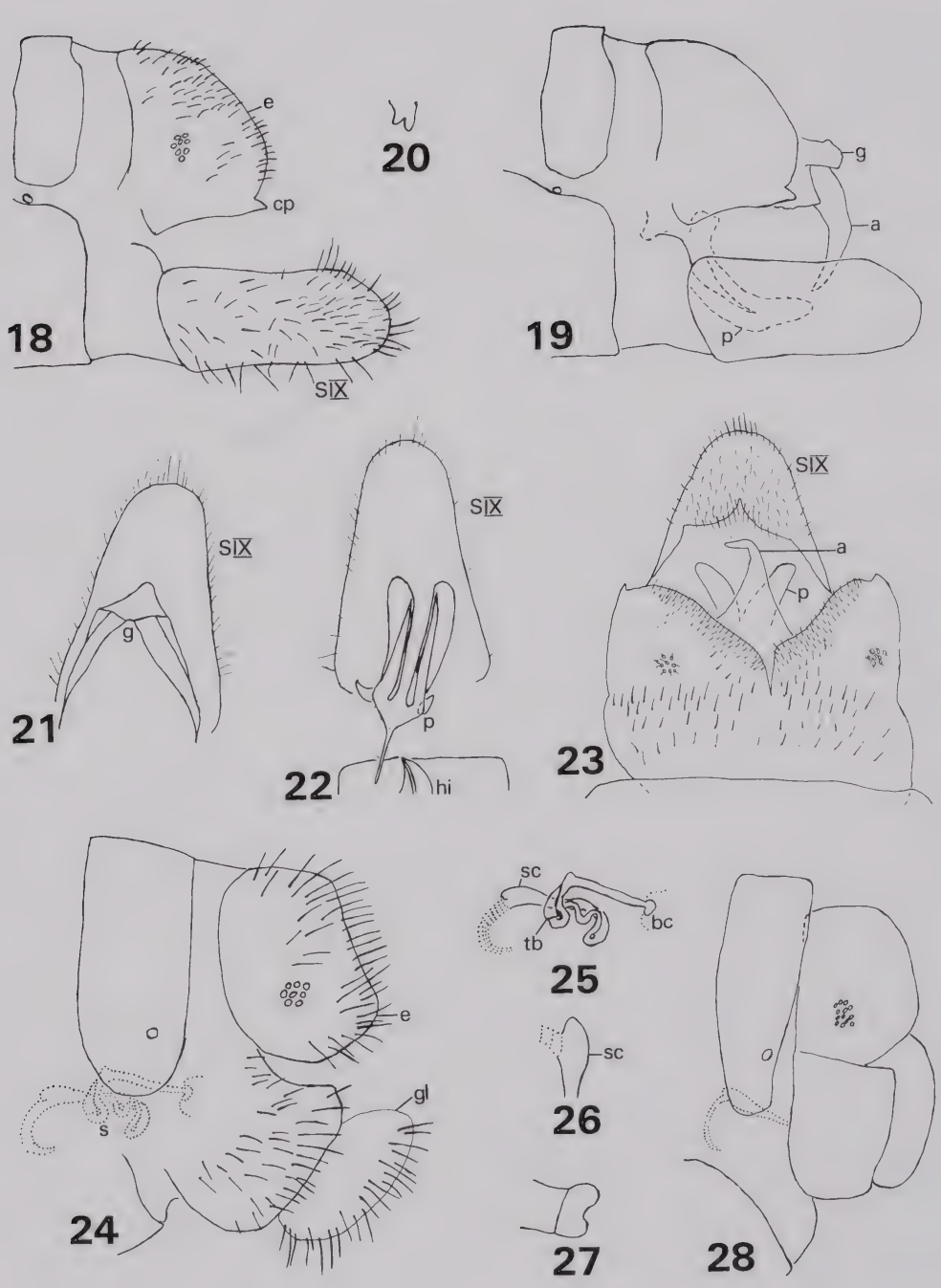
Antennae. Almost unicolorous light brown, darker towards apex; scape large, basal flagellar segment larger than remainder. Males, scape plus 45-58 flagellar segments; females, scape plus 54-64 flagellar segments.

Head. Face (including labrum) pale brown. Dorsum (Fig. 4) extending anteriorly between antennae, setose; posteriorly with irregular tubercles, pale brown with pair of dark brown marks surrounding a smooth pale spot, each mark in shape of stylised head of shepherd's crook. Head laterally pale brown, sometimes with darker brown vertical line behind eye.

Prothorax (Fig. 4) sparsely setose, laterally dull cream, dorsally dark cream with wide median dark brown strip enclosing thin, pale strip on median line.Legs setose, pale brown, apical tarsal segment darker; fore tibiae slightly swollen before apex, mid tibiae swollen before apex, hind tibiae swollen apical two-thirds.

Wings (Fig. 2) elongate, tapering to rounded ends apically. Forewing lightly setose, thickest in pterostigma. Veins light brown with dark brown dashes and spots; gradate cross-veins in two series, dark brown, forming two transverse thin lines. Membrane clear, brown in small patches around apical cross-veins, between two close medial and cubital cross-veins towards base forming an obvious spot, also spots around wing margin. Hindwing main veins light brown to colourless, sometimes parts of veins darker in apical and posterior areas, apical cross-veins darker. Membrane clear, with occasional dark patches on posterior margin.

Wing venation (Fig. 6). Forewing with Costa (C) bowed in basal half, costal area broadest at c. 1/4 of wing, humeral vein simple, some forked veinlets before pterostigma; pterostigma thickened, elongate along Subcosta (Sc), not touching C, smaller than in hindwing. One basal cross-vein Sc to Radius (R). Sc not fused with R. Sc with few forked veinlets at margin, remainder of veins with forked veinlets at margin. Radial sectors (Rs) and Medius (M) arise separately from R. One apical cross-vein R-Rs. Usually four Rs, occasionally 3 or 5 (6 recorded by New 1988); cross-veins present in two gradate series Rs1-Medius



Figs. 18-28. *Micromus tasmaniae*. Genitalia. ♂. 18. Lateral. 19. Parameres *in situ*. Lateral. 20. Apex of arcessus. 21. Gonarcus and outline of Sternite IX. Dorsal. 22. Parameres and outline of Sternite IX. Ventral. 23. Another specimen. Dorsal. Genitalia. ♀. 24. Lateral. 25. Spermatheca. 26. Spermatheca, subapical chamber. Another view. 27. Subgenitale. Ventral. 28. Another specimen. Lateral. (For abbreviations see description).

anterior (Ma). Base of M present, forked with 2 cross-veins in fork; Medius posterior (Mp) forked with 1 cross-vein in fork. Two short cross-veins M, Mp-Cubitus anterior (Cua). Cu forked near base with 2 cross-veins in fork, 1 cross-vein Cubitus posterior (Cup) to Anal 1 (A1). Three anal veins (A1, A2, A3), with cross-veins.

Hindwing with costal area narrow, many simple veinlets. Pterostigma stronger than forewing, extending from Sc to C, with possibly a few forked veinlets apically. No basal cross-vein Sc-R. R forked at apex, remainder of veins with forked veinlets at margin. Rs arising basally with 4 branches, 2 basal cross-veins R-Rs (or 1 stem, 1 cross-vein), 1 apical cross-vein R-Rs. Cross-veins in two gradate series Rs1-Ma. M forked with 2 cross-veins in fork, 1 or 2 apical cross-veins Mp-Cua. Cu arises separately, 2 or 3 A present.

Abdomen dark brown, sometimes paler ventrally; terminal segments pale.

Genitalia (Figs. 18-28). ♂. Ectoproct (e) setose, rounded apically, with short catoprocessus (cp) ventrally. Sternite IX (S IX), elongate, slipper-shaped; dorsal/ventral outlines almost parallel in lateral view; tapering with rounded apex in dorsal/ventral views. Gonarcus (g) extended dorsally over base of arcessus (a); arcessus large, curved, sometimes with tip bifurcate. Parameres (p) fused at base (anteriorly), with a short, broad dorsal process (lateral view); a pair of lateral processes; a pair of thin posterior processes extending into paired, upcurved, posterior membranous lobes. Hypandrium internum (hi) small.
Note. In both species, S IX appears as if the postero-lateral corners of a quadrangular sternite have curled dorsally coming together at the median line (see Fig. 23) and forming a shape like a slipper with covered apical area and curved, raised sides.
♀. Ectoproct (e) rounded posteriorly, gonapophyses laterales (gs) elongate. Spermatheca (s) internally (anteriorly) with apical curved sac, lightly chitinised with series of black points on surface, followed by a more chitinised chamber (sub-apical chamber, sc) slender in outline; duct continuing slightly curved, then strongly curved to a re-curved (u-shaped) bend followed by convolutions ending in a straight entry to bursa copulatrix (bc); a tapering body (tb) present on outside before straight ending to duct. Apex of subgenitale (sg) concave centrally in ventral view.

Wing lengths. Anterior: ♂♂ 5.0-7.5 mm, ♀♀ 6.0-8.0 mm. Posterior: ♂♂ 4.25-6.75 mm, ♀♀ 5.25-7.25 mm.

Specimens. Lectotype. ♀. Saunders 68.3. VDL [Van Diemen's Land]. Tasmaniae W. Hemerobius tasmaniae W det. D.E. Kimmins. Type. (BMNH).
Paralectotype. ♀. Saunders 68.3. Hemerobius tasmaniae W det. D.E. Kimmins. Paratype. (BMNH).
Paralectotype. ?. Saunders 68.3. Hemerobius tasmaniae W det. D.E. Kimmins. Paratype. [3 wings only, body missing]. (BMNH).

N. Zeal. Micromus tasmaniae Wlk. McLachlan Coll. BM 1938-674. ♂, ♀ (BMNH).
48 C.M. Wakefield ChCh NZ. McLachlan Coll. BM 1938-674. 1 (BMNH).
Chatham Isld. 1899. Micromus tasmaniae Walk. McLachlan Coll. BM 1938-674. ♀ (BMNH).
New Zealand 97-166. 96. Micromus tasmaniae Walk ♀ det. D.E.K. ♂ (BMNH).

(10a) New Zealand Hudson. Micromus tasmaniae Wlk. McLachlan Coll. BM 1938- 674. ♀ (BMNH).
(10b) New Zealand Hudson. Micromus tasmaniae Walk. McLachlan Coll. BM 1938-674. 1 (BMNH).
10c (G.V.Hudson. Amongst herbage Botanicals [Botanical Gardens]). 1 (NMNZ).
10d (G.V.H. Amongst herbage Botanicals [Botanical Gardens]).[Missing].
10e (G.V.H. Amongst herbage Botanicals [Botanical Gardens]). [Missing].
10g (G.V.H. Bush Hill Karori, April 3 89). [Missing].
10h (G.V.H. Bush Hill Karori, April 3 89). Wellington Hudson. Mclachlan Coll. BM 1938-674. ♀ (BMNH).
10k (G.V.H. Herbage Botanicals, Oct. 89). [Missing].
10l (G.V.H. Ditto [Herbage Botanicals], Dec. 90). [Missing].
10m (G.V.H. Ditto, Dec. 90). [Missing].
10n (G.V.H. Ditto, Dec. 90). Wellington, Dec. 1890, G.V. Hudson. 1 (CMNZ).
10o (G.V.H. Wadestown, Jan. 17 97). [Missing].
10a (G.V.H. "summer 94-95 W'ton" (ex coll. Hawth.)). [Missing].
10b (G.V.H. Campbells stream, Jan.1 1900). 1 (NMNZ).
10p (G.V.H. Reservoir Reserve Karori, Oct. 22 1911).[Missing].
10q (G.V.H. ditto [Reservoir Reserve Karori], Apl 21 1912). Karori Reservoir Reserve, April 1912, G.V. Hudson. B.M. 1933-274. ♂ (BMNH).
10r (G.V.H. Groves Bush Karori Nov. 7 1915). 1 (NMNZ).
10s (G.V.H. Waterfall gully Wadestown, Dec. 7 1919). 1 (NMNZ).
10s (G.V.H. Waterfall Gully Wadestown, Dec. 7 1919). Wiltons Bush, 7.XII.1919, G.V. Hudson. Brit. Mus. 1938-203. ♀ (BMNH).
10t (G.V.H. Kinloch Lake Wakatipu, early Jan. 1921).[Missing].
10v (G.V.H. Bush Hill Karori, Feb. 27 1921). 1 (NMNZ).
10w (G.V.H. Gollans valley, Jan. 30 1923). Gollans Valley, 30.1.23. G.V.Hudson, B.M. 1936-724. ♀ (BMNH).
(10u) Wiltons Bush, 1894 [in error]. G.V. Hudson, B.M. 1936-724. ♀ (BMNH).
10x (G.V.H. Makara Bush, Feb. 21 1923). [Missing].
10y (G.V.H. Wilton's Bush, Dec. 14 1927). 1 (NMNZ).
(10a) Gollans Valley, Dec. 1932, G.V. Hudson, B.M. 1933-274. 1 (BMNH).
(10d) Wiltons Bush, 9.ii.33, G.V.Hudson. B.M. 1933-274. ♂ (BMNH).
(10) Karori Reservoir Reserve, 18.X.1934, G.V. Hudson. Brit. Mus. 1935-176. ♀ (BMNH).
10z (G.V.H. South Karori, Oct. 5 1935). 1 (NMNZ).
10z (G.V.H. South Karori, Oct. 5 1935). South Karori, 5.X.35. G.V. Hudson, BM. 1936-724. ♀ (BMNH).
10A (G.V.H. Reservoir Reserve [Karori], Nov. 9 1935). 1 (NMNZ).
Wainuiomata, 27.2.1936, G.V.Hudson. Brit. Mus. 1937-209. ♀ (BMNH).
10B (G.V.H. [A re-used number, previous data deleted.] Wiltons Bush, Dec. 28 1942). 1 (NMNZ).
10C (G.V.H. Gollans Valley, Jan. 12 1942). [Missing].
10D (G.V.H. Wilton's Bush, Dec. 8 1943). 1 (NMNZ).
10E (G.V.H. Haywards, Mch. 27 1944). 1 (NMNZ).
10F (G.V.H. Bred from larva obtained at Haywards, 16 Dec. 1944, emerged Feb. 3 1945). 1 (NMNZ).

Paihia, swept, swamp, 1.I.1986, K.A.J. Wise. ♂ (AMNZ).

Paihia, at light, 3.XI.1991, K. Lodge. ♀ (AMNZ).
Titirangi, .III.1915, A.E. Brookes, 1919-201. M. tasmaniae. 1 (BMNH).
Titirangi, .III.1915, A.E. Brookes, 1919-201. ♂ (BMNH).
Ohakune, .XI.1922, T.R. Harris, B.M. 1923-13. Micromus tasmaniae Walk. det. D.E. Kimmins. ♂+ 3 (BMNH).
Ohakune, 1922-1923, T.R. Harris, B.M. 1923-303. ♀ +7 (BMNH).
Te Kaha, Whanarua Bay, swept vegetation by roadside, 4.I.1987, R.S. Gilbert. ♀ (AMNZ).
New Brighton, Dyer's Road, 11.XI.1922, J.W. Campbell, B.M. 1923-14. ♂ (BMNH).
Governors Bay, 2.XII.1921, E.S. Gourlay. Pres. by J.W. Campbell, B.M. 1922-245. ♀ (BMNH).
West Plains, 6.11.05 [original label]. 1 (NZAC).
Stewart I. Halfmoon Bay, 1.II.1969, A.C. Eyles. ♂ (NZAC).

The above records are listed in order of types, early specimens (being mostly McLachlan collection), then G.V. Hudson specimens and the remainder, being a selection of BMNH and other specimens used for the present paper, geographically from north to south.

G.V. Hudson appears to have used some letters more then once, possibly for reference in correspondence. Such use ,where recognised, has been indicated in the list above by placing the number/letter combination in parenthesis. Some specimens included in Hudson's register have not been found and some are recorded below as varieties. At the beginning of the *Micromus tasmaniae* entries (number 10) in the register, 'a', 'b' are not included and may have been the specimens so labelled sent to McLachlan. Hudson used 'a' and 'b' after the 1897 entry 'o' and 'a,b,c,d' for specimens in 1932-33. After a first use of 'u' in 1921 (see varieties below), a second use is here placed with 'w' as they were sent to BMNH at the same time (1936) and the date could be in error.

Type specimens. There are three specimens in the BMNH collection, each with a printed 'Saunders 68.3' label. As Walker (1860) described both male and female and gave minimum-maximum measurements he must have examined at least two specimens, and presumably three (the two with abdomens now are both females), but he did not designate types. These specimens are, therefore, syntypes and such labels have in recent years been placed in the drawer beside the specimens by S.J. Brooks. The 'Type' and 'Paratype' labels may well have been placed there by D.E. Kimmins. Consequently, the specimens are now designated and labelled as 'Lectotype' and 'Paralectotype'.

The lectotype has two extra handwritten labels which appear to be old; one of them, 'VDL', is considered by the present author to be a locality label for Van Diemen's Land and the other, 'Tasmaniae W.', a determination label for the species. The latter label (considered by New 1988 to be a locality label) has a partial ink-blot at the end of the name but the 'a' and 'e' are distinguishable as being written together in the 'æ' form, as they were printed in Walker's 1860 paper.

Type locality. Australia: Tasmania (previously Van Diemen's Land). The locality 'Tasmania' given by Walker (1860) was correct as the name was officially changed in 1856.

Distribution (Fig. 29). McLachlan (1869) gave the first record of *Micromus tasmaniae* for this country, "...and [I] possess two individuals from New Zealand...". The two specimens

now in BMNH labelled 'N. Zeal.' may be those original specimens. The McLachlan Collection specimen from Chatham Is, dated 1899, confirms the record for that island group by Alfken (1904).

The previously known range within New Zealand (Wise 1991) was from the far north of the North Island to the southern end of the South Island, where a specimen had been taken at West Plains in the same year as *M. bifasciatus* types. It is now extended to Stewart I as one specimen was taken in the settlement area of Halfmoon Bay. In the New Zealand sub-region the species is also known from Kermadec Is, Chatham Is, Antipodes Is and Auckland Is.

Anomalous specimens. Some specimens of *Micromus tasmaniae*, previously thought to be varieties, have been examined and found to differ from this species in some respects. Preliminary descriptions, given below, suggest an alternative origin which is discussed.

"Micromus tasmaniae var. *manapouriensis"*

Two specimens, one appears big for species, both appear broad-winged; wings appear plain, veining more obvious than spotting.

Antennae. Almost unicolorous, pale; scape large. Females, scape plus 61, 65 flagellar segments.

Head. Face (including labrum) pale. Dorsum posteriorly strongly rugose (as *bifasciatus*), with a pair of dark patches, no sign of usual *tasmaniae* markings. Head laterally light brown, slightly darker behind eyes.

Prothorax sparsely setose, darker brown dorsally, no obvious pale median strip except 1 specimen with short, pale spot posteriorly, 1 specimen with short, pale spots anteriorly and posteriorly. Legs pale brown.

Wings. Forewing similar to *tasmaniae*, some veins pinkish, brown spotting not strong. Spotted on radius at radial sectors. Membrane shaded golden brown; one specimen with short, faint spot between short marks on close medial and cubital veins towards base (as *tasmaniae*), one with cell membrane slightly darker in basal 3/4 of cell and no spot (more as *bifasciatus*). Hindwings with some veins slightly pinkish.

Wing venation. Forewing as *tasmaniae*; 4 Radial sectors, 1 specimen with aberration in 1 wing with basal Radial sector arising from medial vein.

Abdomen darkish brown, terminal segments slightly paler.

Wing lengths. ♀♀ Anterior: 7.25-8.25 mm. Posterior: 6.5-7.5 mm.

Specimens. Manapouri, 13.2.20 [original labels, 2 spec.]. M. tasmaniae Walk. var. manapouriensis Till. [1 spec.] (Tillyard 1923 - 13th February, 1920, Philpott, 2). 2♀♀ (NZAC).

Although Tillyard (1923) did not record a locality for this variety, his label on one of the

two specimens and the derivation of the varietal name from a place, being the place where they were collected (Manapouri), makes it certain that these are the correct specimens.

"Micromus tasmaniae var. *nigroscriptus"*

Small pale specimen (NZAC). Wings almost without markings, only dark apical marks present. Two specimens in the BMNH collection have dark marks towards the apex. Two recent specimens (AMNZ) with head, body, upper legs suffused with pale green; anterior wings suffused with pale golden-brown, dark brown-black apical patch.

Antennae pale. Scape large. Scape plus 65 flagellar segments, other specimens with 57-64.

Head. Face(including labrum) pale. Dorsum posteriorly with pair of brown marks in same form as *tasmaniae*; one (BMNH) with corrugations (as *bifasciatus*). Head laterally pale. Recent specimens dorsally with smooth pale spots (as *tasmaniae*), laterally with light brown mark behind eyes continuing as lateral line on prothorax.

Prothorax sparsely setose. Dark brown dorsally with thin pale median strip partially visible. Other specimens with mid-dorsal line darker (as *bifasciatus*), or with pale mid-dorsal line (more as *tasmaniae*) partial or not distinct. Legs pale.

Wings. Forewing membrane, most veins/veinlets colourless. Slight dotting on radius at radial sectors. Parts of veins, outer gradate cross-veins light brown (marks described as black, Tillyard 1923) in apical area of radius to radial sector 4. Four inner gradate cross-veins light brown. Membrane between two close medial and cubital veins towards base slightly darker in elongate central area of cell (described as curved black stripe, Tillyard 1923; as *bifasciatus*). Cubitus vein light brown showing as light brown line to marginal veinlets then short extension towards base. Two BMNH specimens, with veins pale or pinkish; anterior wings spotted with brown or pink, with isolated dark patch towards apex , dark mark towards base, 1 with dark streak between close medial and cubital veins (as *bifasciatus*). Two recent specimens (AMNZ), spotted on costa and radius particularly at 4 radial sectors (as *tasmaniae*), 1 with apical dark patch formed by coalition of dark markings, also with dark streak on membrane between two close medial and cubital veins towards base for 2/3 of cell (as *bifasciatus*) ; 1 with cross-veins brown in apical area, apical patch reduced, also with brown spot between close veins towards base (as *tasmaniae*). Hindwing veins and membrane colourless except for light brown in apical radius to radial sector area, cubitus vein to margin light brown. Recent specimens mainly clear; 1 dark with dark apical patch, 1 light with apical cross-veins brown. Markings re-inforce dark marks of anterior wings when wings closed.

Wing venation. Forewing with 4 Radial sectors.

Abdomen. Missing (from original specimen). One BMNH specimen, abdomen pale brown. Two recent specimens (AMNZ), abdomen darker dorsally.

Wing lengths. ♀♀ Anterior: 7.25-8.0 mm. Posterior: 6.75-7.25 mm.

Specimens. Nelson N.Z., 29.12.20, A. Philpott [original label]. M. tasmaniae (Wlkr) var. nigroscriptus Till. (Tillyard 1923 - Nelson, 29th December, 1920, Philpott, 1). 1 (NZAC).

(10b) Gollans Valley, Dec. 1932, G.V. Hudson B.M. 1933-274. ♀ (BMNH).
(10c) Gollans Valley, Dec. 1932, G.V. Hudson B.M. 1933-274. M. tasmaniae v. nigroscriptus Till. det. D.E. Kimmins. ♀ (BMNH).

Woodhaugh, Dunedin, 7.I.1990, B.H. Patrick. 2 ♀♀ (AMNZ).

The specimens of *nigroscriptus* are so distinct that the present author reacted to recent fresh specimens as did Tillyard who stated (1923) "At first sight it would appear to be a new species ...". He also noted that the corresponding portions of forewings and hindwings were marked in black so with the wings folded the darkened areas reinforced each other.

"*Micromus tasmaniae* var."

10u (G.V.H. Lower slopes of Mt Aurum, Jan. 17-19 1921, 3000 feet [c. 914 m]). 1 (NMNZ).

This specimen, recently brought to notice (NMNZ), has even more widespread dark markings on veins and membrane of the forewing and also on veins of the hindwing, particularly along the costa. It is included here as it is other than typical, but it has not yet been closely examined.

Distribution of anomalous specimens (Fig. 29). Of the two named varieties, specimens of *manapouriensis* occurred at one locality in the South Island and those of *nigroscriptus* at two localities in the South I and one in the North I. The unnamed 'variety' is from the southern South I. They are all within the range for *M. tasmaniae* .

Life history. Micromus tasmaniae was collected by Hudson since at least 1889 in the Wellington area and he recorded (1904) that adults occur throughout the year and that he had "... often met with it in the depth of winter." He also mentioned that "...it is more frequently observed on the lower surfaces of objects resting partially on the ground.", and white (unpigmented) specimens have been taken from leaf litter samples, which suggests that larvae pupate in this medium.

In New Zealand, most species of farm trees, orchard trees, ornamental trees, ornamental shrubs, crop plants, flower plants, vegetable plants and weeds are introduced and a large number of aphid species has also been introduced. *Micromus tasmaniae* is a well-known predator of aphids in Australia and New Zealand, and with such a large food supply on such a wide range of plants it is the most common lacewing in both countries.

Broun's (1898) record of *Chrysopa* as being common probably referred to *M. tasmaniae* and this species has been recorded since as a predator of pest species by Myers (1921), Gourlay (1930), Clark (1932) on introduced Adelgidae, Miller & Clark (1935), Carter (1949) on Triozidae (Psylloidea), Cumber & Eyles (1961), Valentine (1964, 1967) and Farrell & Stufkens (1988, 1990). The species was also the subject of a university thesis by Hilson (1964), and another university study by Syrett (including physiology, Syrett & Penman 1981)

Fig. 29. Map of New Zealand with localities of *Micromus bifasciatus* Tillyard, 1923 and *Micromus tasmaniae* "varieties". and overall distribution of *Micromus tasmaniae* (Walker, 1860).

and is included in general works such as *New Zealand pest and beneficial insects* (Scott 1984) and Cameron *et al.* (1989) on biological control.

Gourlay (1964) recorded that *M. tasmaniae* is parasitised by *Anacharis zealandica* Ashmead, "... parasitism occurs after the larva ... spins the coccoon".

COMPARISON OF *MICROMUS BIFASCIATUS* AND *M. TASMANIAE*

The two species are similar in most characters. The wing venation and genitalia of males and females are of the same pattern. There is a slight difference in wing shape, that of *M. bifasciatus* being more slender. The dorsum of the head shows a distinct specific difference both in tuberculation and colour pattern. The colour pattern of the anterior wings is also specifically different, *M. bifasciatus* has two obvious brown transverse bands and a brown streak between close medial and cubital veins while *M. tasmaniae* has a spotted appearance including a brown spot between the close medial and cubital veins. While the male genitalia need to be further examined, the shape of the ectoproct, arcessus, parameres and Sternite IX are of the same pattern; Sternite IX shows some differences in shape and the parameres show a tangible specific difference in the shape of the dorsal process. The female genitalia are very close in pattern; perhaps the only specific difference being in the shape of the sub-apical chamber of the spermatheca.

MICROMUS TASMANIAE VARIETIES OR *M. BIFASCIATUS X M. TASMANIAE?*

Individuals of *Micromus tasmaniae* are usually very uniform, with spotted wings, with the darkness or extent of the transverse lines on the gradate cross-veins being the only variation easily seen. The author knows of no varieties, such as those described by Tillyard from New Zealand specimens, that have been recorded among Australian specimens. There seems to be another influence in New Zealand, perhaps the presence of *M. bifasciatus*, a very closely related species. Both the named varieties of *M. tasmaniae* are based on specimens with some characters tending to those of *M. bifasciatus* and it is possible that these specimens, particularly those of the outstanding *nigroscriptus* form, are hybrids of the two species.

An extreme view would be to consider the *tasmaniae* 'varieties' as intermediates linking *tasmaniae* and *bifasciatus* as one species, but this view is not accepted here on account of the distinct and constant wing, head and prothorax markings, slight genitalic differences, the different groups of insects preyed upon and the different countries of origin.

DISCUSSION

Although both species occur through the length of both North and South Islands, they are probably separated by their food requirements. As noted above, *M. bifasciatus* is associated with endemic podocarp forest trees, which are host plants for endemic Coccoidea, and *M. tasmaniae* with a large array of plants, in open and cultivated areas, which are host plants for Aphidoidea.

An interesting result has come from some Forest Research Institute collecting in a marginal area of the Pureora State Forest Park, Waipapa Reserve, north-west of Lake Taupo.

Malaise traps were set in shrubland and c. 200 m inside Podocarp forest (including rimu), almost a kilometre apart and out of sight of each other. Between 1 December 1983 and 29 March 1984 *M. tasmaniae* specimens were taken from the shrubland trap on 12 days while, from the forest trap one *M. bifasciatus* was taken in February and one *M. tasmaniae* in March. Although small numbers, these records are consistent with the suggestion that *M. bifasciatus* is associated with areas of native trees and *M. tasmaniae* mainly with open vegetation. Similarly, on Stewart I, *M. bifasciatus* occurs in endemic forest and the one known occurrence of *M. tasmaniae* is from the only settlement, where there are gardens.

Nakahara (1960) placed *M. tasmaniae* in a separate genus (since synonymised with *Micromus*), on the basis of genitalic characters, and New (1988) commented that this species "is very distinct on its 'speckled' wing venation and on genitalic features". Now that the form of the genitalia of *Micromus bifasciatus* and *Micromus tasmaniae* is seen to be very close, it seems that they are separate from other species of *Micromus* and can be considered sister species.

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REFERENCES

ALFKEN, J.D.
1904 Beitrag zur Insektenfauna der Hawaiischen und Neuseelandischen Inseln. *Zool. Jb.* 19: 561-628.

BROUN, T.
1898 Report of Captain T. Broun F.E.S., Assistant Entomologist, Auckland. *In* T.W. Kirk, *Rep. Dep. Agric. N.Z.* 1898: 216-227.

CAMERON, P.J., R.L. HILL, J. BAIN, W.P. THOMAS (Eds.)
1989 A review of biological control of invertebrate pests and weeds in New Zealand 1874 to 1987. *Tech. comm., CAB Int. Inst. Biolog. Control* 10: 1-242.

CARTER, M.W.
1949 The *Pittosporum* chermid, *Powellia vitreoradiata* Mask. *N.Z. J. Sci. Tech.* (B)31(2): 31-42.

CLARK, A. F.
1932 Insects infesting *Pinus radiata* in New Zealand. *N.Z. J. Sci. Tech.* 13(4): 235-249.

COX, J.M.
1987 Pseudococcidae (Insecta: Hemiptera). *Fauna of N.Z.* No. 11: 5-228.

CUMBER, R.A., and A.C. EYLES
1961 Insects associated with the major fodder crops in the North Island. VI. Odonata, Orthoptera, Isoptera, Psocoptera, Thysanoptera, Neuroptera, Lepidoptera. *N.Z. J. Agric. Res.* 4: 426-440.

FARRELL, J.A., and M.W. STUFKENS
1988 Abundance of the rose-grain aphid, *Metopolophium dirhodum*, on barley in Canterbury New Zealand, 1984-87. *N.Z.J. Zool.* 15: 499-505.
1990 The impact of *Aphidius rhopalosiphi* (Hymenoptera: Aphidiidae) on populations of the rose grain aphid (*Metopolophium dirhodum* (Hemiptera: Aphididae) on cereals in Canterbury, New Zealand. *Bull. Ent. Res.* 80: 377-383.

GOURLAY, E.S.
1930 Preliminary host-list of the entomophagous insects in New Zealand. *Bull. N.Z. D.S.I.R.* No. 22: 1-13.
1964 Notes on New Zealand insects and records of introduced species. *N.Z. Ent.* 3(3): 45-51.

HILSON, R.J.D.
1964 The ecology of *Micromus tasmaniae* (Walker). Unpublished M.Sc.(Hons.) Thesis, University of Canterbury. 100p.

HUDSON, G.V.
1904 *New Zealand Neuroptera*. London, West, Newman. 102p.
1950 Observations on New Zealand Neuroptera. In *Fragments New Zealand Entomology*. Wellington, Ferguson & Osborn. pp. 116-122.

HUTTON, F.W.
1874 A list of the insects recorded as having been found in New Zealand previous to the year 1870. *Trans. Proc. N.Z. Inst.* 6: 158-171.
1899 The Neuroptera of New Zealand. *Trans. Proc. N.Z. Inst.* 31: 208-249.
1904 *Index Faunae Novae Zealandiae*. London, Dulau. 372p.

McLACHLAN, R.
1869 New species, & c., of Hemerobiina; with synonymic notes (First series). *Ent. Mon. Mag.* 6: 21-27.
1873 A catalogue of the neuropterous insects of New Zealand; with notes, and descriptions of new forms. *Ann. Mag. Nat. Hist.* (4)12(67): 30-42.
1874 A catalogue of the neuropterous insects of New Zealand; with notes and descriptions of new forms. *Trans. Proc. N.Z. Inst.* 6: App. xc-xcix. (Repr. of McLachlan, 1873).

MILLER, D., and A.F. CLARK
1935 Control of forest insect pests. Distribution of parasites in New Zealand. *N.Z. J. Sci. Tech.* 16(5): 301-307.

MONSERRAT, V.J.
1990a Systematic studies on Hemerobiidae (Insecta: Neuroptera). In *Advances in Neuropterology*. Proc. 3rd. Int. Symp. Neuropterology. M.W. Mansell, H. Aspöck (Eds.). Pretoria. 298p. pp. 67-88.

1990b A systematic checklist of the Hemerobiidae of the world (Insecta: Neuroptera). In *Advances in Neuropterology*. Proc. 3rd. Int. Symp. Neuropterology. M.W. Mansell, H. Aspöck (Eds.). Pretoria. 298p. pp. 215-262.

MORALES, C.F.
1991 Margarodidae (Insecta: Hemiptera). *Fauna of N.Z.* No. 21: 7-123.

MYERS, J.G.
1921 Insect pests of lucerne and clover. Observations in the Marlborough seed-growing area. *N.Z. J. Agric.* 23: 156-162.

NAKAHARA, W.
1960 Systematic studies on the Hemerobiidae (Neuroptera). *Mushi* 34(1): 1-69.

NEW, T.R.
1988 A revision of the Australian Hemerobiidae (Insecta: Neuroptera). *Invertebr. Taxon.* 2: 339-411.

ROBERTS, L.I.N.
1979 Insects from the Cavalli Islands. *Tane* 25: 125-131.

SCOTT, R.R. (Ed.)
1984 *New Zealand pest and beneficial insects*. Christchurch, Lincoln University College of Agriculture. 373p.

SPILLER, D., and K.A.J. WISE
1982 A catalogue (1860-1960) of New Zealand insects and their host plants. *N.Z. Dep. Sci. Industr. Res. Bull.* 231: 1-260.

SYRETT, P., and D.R. PENMAN
1981 Development threshold temperature for the brown lacewing, *Micromus tasmaniae* (Neuroptera: Hemerobiidae). *N.Z. J. Zool.* 8: 281-283.

TILLYARD, R.J.
1916 Studies in Australian Neuroptera. No. IV. The Families Ithonidae, Hemerobiidae, Sisyridae, Berothidae, and the new Family Trichomatidae; with a discussion of their characters and relationships, and descriptions of new and little-known genera and species. *Proc. Linn. Soc. N.S.W.* 41(2): 269-332.
1923 Descriptions of new species and varieties of lacewings (Order Neuroptera Planipennia) from New Zealand, belonging to the families Berothidae and Hemerobiidae. *Trans. N.Z. Inst.* 54: 217-225.

VALENTINE, E.W.
1964 Integration of biological and chemical methods of pest control. *N.Z. Sci. Rev.* 22(2): 14-16.
1967 A list of the hosts of entomophagous insects of New Zealand. *N.Z. Sci.* 10(4): 1100-1209.

WALKER, F.
1860 Characters of undescribed Neuroptera in the collection of W.W. Saunders, Esq., F.R.S., & c. *Trans. Ent. Soc. London* N.S. 5(5): 176-199.

WISE, K.A.J.
1963 A list of the Neuroptera of New Zealand. *Pacific Ins.* 5 (1): 53-58.

1971 Entomology of the Aucklands and other islands south of New Zealand. Neuroptera: Hemerobiidae. *Pacific Ins. Mon.* 27: 53.
1972 Neuroptera of the Kermadec Islands. *Rec. Auckland Inst. Mus.* 9: 269-272.
1973 New records in the New Zealand Neuroptera: Hemerobiidae. *N.Z. Ent.* 5 (2):181-185.
1977 A synonymic checklist of the Hexapoda of the New Zealand sub-region. The smaller Orders. *Bull. Auckland Inst. Mus.* 11: 1-176.
1983 Lacewings and aquatic insects of New Zealand. 2. Fauna of the northern offshore islands. *Rec. Auckland Inst. Mus.* 20: 259-271.
1985 Lacewings and aquatic insects of New Zealand. 3. Fauna of Poor Knights Islands. *Rec. Auckland Inst. Mus.* 22: 97-103.
1988 Lacewings and aquatic insects of New Zealand. 4. New records and further distributions for Neuroptera. *Rec. Auckland Inst. Mus.* 25: 181-184.
1991 Distribution and zoogeography of New Zealand Megaloptera and Neuroptera. *Rec. Auckland Inst. Mus.* 28: 211-227.

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